Federal Aviation Agency

Washington, D.C.

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Civil Aeronautics Manual 4b

## Airplane Airworthiness; Transport Categories

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**Supplement No. 1, CAM 4b dated September 1962** **Feb. 1, 1963**

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SUBJECT: Revisions to CAM 4b

This supplement is issued to incorporate into CAM 4b Civil Air Regulations Amendment 4b–13, and Amendments Nos. 1 and 2 to Special Civil Air Regulation No. SR–422B, and to delete Special Civil Air Regulation No. SR–423 which terminated December 20, 1962.

Amendment No. 1 to Special Civil Air Regulation No. SR–422B concerns three-engine airplanes. It was issued December 10, 1962, and became effective January 15, 1963.

Amendment 4b–13 and Amendment No. 2 to SR–422B concern turboprop conversions of transport category airplanes. They were issued and became effective December 20, 1962.

In the September 1962 revision of CAM 4b, paragraph (b) of section 4b.307 was inadvertently omitted. This error is being corrected by this supplement.

New or revised material is enclosed in black brackets on the pages submitted with this supplement, except the pages in the addendum containing the preambles of amendments. All new pages have been provided for the addendum to correct an error in pagination.

| *Remove the following pages:* | *Insert the following new pages:* |
|---|---|
| XV and XVI | XV and XVI |
| 5 and 6 | 5 through 6–1 |
| 89 and 90 | 89 through 90–1 |
| 293 through 304 | 293 through 304–1 |
| 309 through 313 | 309 and 310 |
| P–3 through P–22 | P–3 through P–25 |

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ATTACHMENTS.

**conditions likely to occur at the particular location.**

**(3) *Flame-resistant.* Flame-resistant material means material which will not support combustion to the point of propagating, beyond safe limits, a flame after the removal of the ignition source.**

**(4) *Flash-resistant.* Flash-resistant material means material which will not burn violently when ignited.**

**(5) *Flammable.* Flammable pertains to those fluids or gases which will ignite readily or explode.**

**(h) *Miscellaneous.***

**(1) *Supplemental breathing equipment.* Supplemental breathing equipment is equipment designed to supply the supplementary oxygen required to protect against anoxia at altitudes where the partial pressure of oxygen in ambient air is reduced. (See sec. 4b.651.)**

**(2) *Protective breathing equipment.* Protective breathing equipment is equipment designed to prevent the breathing of noxious gases which might be present as contaminants in the air within the airplane in emergency situations. (See sec. 4b.651.)**

**(Amendment 4b–12, published 27 F.R. 2986, Mar. 30, 1962, effective May 3, 1962.)**

## Certification

**4b.10 *Eligibility for type certificates.* An airplane shall be eligible for type certification under the provisions of this part if it complies with the airworthiness provisions established by this part or if the Administrator finds that the provision or provisions not complied with are compensated for by factors which provide an equivalent level of safety: *Provided,* That the Administrator finds no feature or characteristic of the airplane which renders it unsafe for the transport category.**

4b.10–1 *Approval of reverse thrust propellers (FAA policies which apply to sec. 4b.10).* A reverse thrust propeller is a design feature which is not fully covered in the Civil Air Regulations. When an airplane incorporates a reverse thrust propeller installation, it will be approved in accordance with the policies set forth in section 4b.402–1, provided it has no feature or characteristic which renders its use unsafe in transport category airplanes.

(20 F. R. 2277, Apr. 8, 1955, effective Apr. 30, 1955.)

4b.10–2 *Approval of automatic propeller feathering installations (FAA policies which apply to sec. 4b.10).* An automatic propeller feathering device is a design feature not specifically covered in the Civil Air Regulations. When an airplane incorporates an automatic feathering device, it will be acceptable under the provisions of section 4b.10 as providing an equivalent level of safety in showing compliance with sections 4b.115, 4b.116, 4b.120, and 4b.133 if it complies with policies prescribed in sections 4b.115–2, 4b.116–1, 4b.120–1, 4b.401–1, and 4b.700–1, and if there are no features or characteristics which make it unsafe for use on transport aircraft.

(19 F. R. 1817, Apr. 2, 1954, effective Apr. 2, 1954.)

4b.10–3 *Minimum quantity of antidetonant fluid required (FAA policies which apply to sec. 4b.10).* The use of antidetonant fluid in limited quantities as a supplemental fluid for takeoff power operations is a feature not specifically covered in the Civil Air Regulations. A system incorporating antidetonant fluid will be acceptable under the provisions of section 4b.10 as providing a satisfactory level of safety from the standpoint of the quantity of fluid available if it complies with the policies contained in sections 4b.420–1 and 4b.718–1.

(20 F. R. 2277, Apr. 8, 1955, effective Apr. 30, 1955.)

**4b.11 *Designation of applicable regulations.* The provisions of this section shall apply to all airplane types certificated under this part irrespective of the date of application for type certificate.**

**(a) Unless otherwise established by the Board, the airplane shall comply with the provisions of this part together with all amendments thereto effective on the date of application for type certificate, except that compliance with later amendments may be elected or required pursuant to paragraphs (c), (d), (e), [and (f)] of this section.**

**(b) If the interval between the date of application for type certificate and the issuance of the corresponding type certificate exceeds five years, a new application for type certificate shall be required, notwithstanding the applicant**

may have been issued a provisional type certificate, except that for applications pending on May 1, 1954, such five-year period shall commence on that date. At the option of the applicant, a new application may be filed prior to the expiration of the five-year period. In either instance the applicable regulations shall be those effective on the date of the new application in accordance with paragraph (a) of this section.

(c) During the interval between filing the application and the issuance of a type certificate, the applicant may elect to show compliance with any amendment of this part which becomes effective during that interval, in which case all other amendments found by the Administrator to be directly related shall be complied with.

(d) Except as otherwise provided by the Administrator pursuant to section 1.24 of this subchapter, a change to the type certificate (see sec. 4b.13 (b)) may be accomplished, at the option of the holder of the type certificate, either in accordance with the regulations incorporated by reference in the type certificate pursuant to section 4b.13 (c), or in accordance with subsequent amendments to such regulations in effect on the date of application for approval of the change, subject to the following provisions:

(1) When the applicant elects to show compliance with an amendment to the regulations in effect on the date of application for approval of a change, he shall show compliance with all amendments which the Administrator finds are directly related to the particular amendment selected by the applicant.

(2) When the change consists of a new design or a substantially complete redesign of a component, equipment installation, or system installation of the airplane, and the Administrator finds that the regulations incorporated by reference in the type certificate pursuant to section 4b.13 (c) do not provide complete standards with respect to such change, he shall require compliance with such provisions of the regulations in effect on the date of application for approval of the change as he finds will provide a level of safety equal to that established by the regulations incorporated by reference at the time of issuance of the type certificate.

NOTE: Examples of new or redesigned components and installations which might require compliance with regulations in effect on the date of application for approval, are: New powerplant installation which is likely to introduce additional fire or operational hazards unless additional protective measures are incorporated; the installation of an autopilot, a pressurization system, or a new electric power system.

(e) If changes listed in subparagraphs (1) through (3) of this paragraph are made, the airplane shall be considered as a new type, in which case a new application for type certificate shall be required and the regulations together with all amendments thereto effective on the date of the new application shall be made applicable in accordance with paragraphs (a), (b), (c), and (d) of this section.

(1) A change in the number of engines;

(2) A change to engines employing different principles of propulsion;

(3) A change in design, configuration, power, or weight which the Administrator finds is so extensive as to require a substantially complete investigation of compliance with the regulations.

[(f) Except as otherwise required by paragraph (e) (3) of this section compliance with the provisions of subparagraphs (1) and (2) of this paragraph is required for the type certification of a turbopropeller-powered airplane which was previously type certificated with the same number of reciprocating engines:

[(1) The requirements of this part applicable to the airplane as type certificated with reciprocating engines and, in addition thereto or in lieu thereof as appropriate, the provisions of subdivisions (i) through (iv) of this subparagraph, effective on the date of application for type certification of the turbopropeller-powered airplane;

[(i) The certification performance requirements prescribed in paragraph (2) of Special Civil Air Regulation No. SR–422B;

[(ii) The powerplant requirements of this part applicable to the turboprop airplane;

[(iii) The requirements of this part for the standardization of cockpit controls and instruments, except when a showing of compliance with a particular detailed requirement would be impractical and would not contribute materially to standardization; and

[(iv) Such other requirements of this part applicable to the turboprop airplane which are found to be related to the changes in engines and which are necessary to insure a level of safety of the turboprop airplane equivalent to that established for the airplane certificated with reciprocating engines.

[(2) If new limitations are established with respect to weight, speed, or altitude of operation, which are significantly altered from those approved for the airplane with reciprocating engines, compliance shall be shown with all of the requirements of this part, applicable to the specific limitations being changed, which are in effect on the date of application for type certification of the turbopropeller-powered airplane.]

(Amendment 4b–12, published 27 F.R. 2986, Mar. 30, 1962, effective May 3, 1962; [Amendment 4b–13, published 27 F.R. 12925, Dec. 29, 1962, effective Dec. 20, 1962.])

4b.12 *Recording of applicable regulations.* The Administrator, upon the issuance of a type certificate, shall record the applicable regulations with which compliance was demonstrated. Thereafter, the Administrator shall record the applicable regulations for each change in the type certificate which is accomplished in accordance with regulations other than those recorded at the time of issuance of the type certificate. (See sec. 4b.11.)

4b.13 *Type certificate.*

(a) An applicant shall be issued a type certificate when he demonstrates the eligibility of the airplane by complying with the requirements of this part in addition to the applicable requirements in Part 1 of this subchapter.

(b) The type certificate shall be deemed to include the type design (see sec. 4b.14 (b)), the operating limitations for the airplane (see sec. 4b.700), and any other conditions or limitations prescribed by the regulations in this subchapter.

(c) The applicable provisions of this part recorded by the Administrator in accordance with section 4b.12 shall be considered as incorporated in the type certificate as though set forth in full.

**4b.304 *Protection.***

**(a) All members of the structure shall be suitably protected against deterioration or loss of strength in service due to weathering, corrosion, abrasion, or other causes.**

**(b) Provision for ventilation and drainage of all parts of the structure shall be made where necessary for protection.**

**(c) In seaplanes, special precautions shall be taken against corrosion from salt water, particularly where parts made from different metals are in close proximity.**

**4b.305 *Inspection provisions.* Means shall be provided to permit the close examination of those parts of the airplane which require periodic inspection, adjustment for proper alignment and functioning, and lubrication of moving parts.**

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

**(a) Material strength properties shall be based on a sufficient number of tests of material conforming to specifications to establish design values on a statistical basis.**

**(b) The design values shall be so chosen that the probability of any structure being understrength because of material variations is extremely remote. 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.**

**(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.**

**(d) The strength, detail design, and fabrication of the structure shall be such as to minimize the probability of disastrous fatigue failure. (See also sec. 4b.270.)**

**NOTE: Points of stress concentration are one of the main sources of fatigue failure.**

**(Amendment 4b–12, published 27 F.R. 2986, Mar. 30, 1962, effectively May 3, 1962.)**

4b.306–1 *Material strength properties (FAA policies which apply to sec. 4b.306 (c)).*

(a) In the case of structures where the applied loads are eventually distributed through a single member within an assembly, the failure of which would result in the loss of the structural integrity of the component involved, the guaranteed minimum design mechanical properties ("A" values) listed in MIL–HDBK–5 [8] should be used for design.

(b) Redundant structures wherein failure of individual elements would result in the applied load being safely distributed to other load-carrying members, may be designed on the basis of the "90 percent probability" ("B" values).

(c) When strength testing is employed to establish design allowables, such as in the case of sheet-stiffener compression tests, the test results should be reduced through use of a materials correction factor to values which would be met by material having the design allowable material properties for the part under consideration. MIL–HDBK–5 outlines methods of accomplishing this reduction but these are by no means considered as the only methods available.

(d) Use of design values greater than the guaranteed minimums is permissible in applications where only guaranteed minimum values are normally permitted provided that the higher values are substantiated by "premium selection" of the material. These increased design allowables will be acceptable providing that a specimen or specimens of each individual

[8] MIL–HDBK–5 "Strength of Metal Aircraft Elements" specifies "A" and "B" values for allowable design properties. The "A" values are those which the material producer has indicated to be the minimum he expects for the given material. The only values considered guaranteed values are the tensile ultimate and tensile yield "A" values which have been published by the material producer for the grain direction accepted for commercial guarantees. The "B" values represent design properties which the materials producers have indicated will be met or exceeded by 90 percent of the material supplied by them. More detailed information on the derivation of related design mechanical properties can be obtained by referring to section 3.1.1 "Material Properties."

item are tested prior to its use, to assure that the strength properties of the particular item will equal or exceed the properties to be used in design. Such quality control should also be exercised for the manufacture of spare parts.

(20 F.R. 2278, Apr. 8, 1955, effective Apr. 30, 1955; amended 27 F.R. 2986, Mar. 30, 1962, effective May 3, 1962.)

**4b.307 *Special factors.* Where there is uncertainty concerning the actual strength of a particular part of the structure, or where the strength is likely to deteriorate in service prior to normal replacement of the part, or where the strength is subject to appreciable variability due to uncertainties in manufacturing processes and inspection methods, the factor of safety prescribed in section 4b.200 (a) shall be multiplied by a special factor of a value such as to make the probability of the part being understrength from these, causes extremely remote. The following special factors shall be used:**

**(a) *Casting factors.* For structural castings, the factor of safety prescribed in section 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 section 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.**

***(b) Bearing factors.***

**(1) Bearing factors shall be used of sufficient magnitude to provide for the effects of**

normal relative motion between parts and in joints with clearance (free fit) which are subject to pounding or vibration. (Bearing factor values for control surface and system joints are specified in sections 4b.313(a) and 4b.329(b).)

(2) A bearing factor need not be employed on a part if another special factor prescribed in this section is of greater magnitude than the bearing factor.

(c) *Fitting factors.*

(1) A fitting factor of at least 1.15 shall be used on all fittings the strength of which is not proven by limit and ultimate load tests in which the actual stress conditions are simulated in the fitting and the surrounding structure. This factor shall apply to all portions of the fitting, the means of attachment, and the bearing on the members joined.

# SPECIAL CIVIL AIR REGULATION NO. SR–422B

(As amended by Amendment No. 1, issued Dec. 10, 1962, effective Jan. 15, 1963, published in 27 F.R. 12399, Dec. 14, 1962, and Amendment No. 2, issued Dec. 20, 1962, effective Dec. 20, 1962, published in 27 F.R. 12926, Dec. 29, 1962.)

Effective: July 9, 1959
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(24 F.R. 5629)
Corrected: July 14, 1959
(24 F.R. 5688)

Turbine-Powered Transport Category Airplane of Current Design

**Special Civil Air Regulation No. SR–422, effective August 27, 1957, prescribes requirements applicable to the type certification and operation of turbine-powered transport category airplanes for which a type certificate is issued after August 27, 1957. Special Civil Air Regulation No. SR–422A, effective July 2, 1958, included substantive changes to SR–422 and was made applicable to all turbine-powered transport category airplanes for which a type certificate is issued after September 30, 1958.**

**This Special Civil Air Regulation makes further changes to the airworthiness rules for turbine-powered transport category airplanes to be applicable to all such airplanes for which a type certificate is issued after August 29, 1959. These changes were proposed in Draft Release No. 58–1C (24 F.R. 128) by the Civil Aeronautics Board in connection with the 1958 Annual Airworthiness Review. The amendments herein have been adopted after careful consideration of all the discussion and comment received thereon.**

**Substantive and minor changes have been made to the provisions of SR–422A. For ease in identification they are listed as follows:**

**(a) Substantive changes: introductory paragraphs; 4T.114 (b), (c), (d), (e), and (f); 4T.115(d); 4T.117a(b); 4T.120 (a)(3), (b), and (d); 40T.81(c); 43T.11(c); and item 5 (a) and (b).**

**(b) Minor changes; item 2; 4T.112 (title), (b)(1), (c), (d), and (e); 4T.113(b); 4T.116(i)(4); 4T.117(b) (1) and (2); 4T.120(a); 4T.121; 4T.122(d); 4T.123(a); 40T.82; and 40T.83.**

**Pertinent background information to this regulation is contained in the preambles to SR–422 and SR–422A. Following is a discussion of important issues relevant to the changed provisions contained herein.**

**One of the most important changes being introduced concerns the rotation speed $V_R$ of the airplane during takeoff (4T.114). Experience gained in the certification of airplanes under the provisions of SR–422 and SR–422A indicates that relating $V_R$ to the stall speed is not essential and might unduly penalize airplanes with superior flying qualities. It has been found that the primary limitations on $V_R$ should be in terms of a margin between the actual lift-off speeds $V_{LOF}$ and the minimum unstick speed $V_{MU}$ at which the airplane can proceed safely with the takeoff. The provisions contained herein require that $V_R$ speeds be established to be**

applicable to takeoffs with one engine inoperative as well as with all engines operating. The $V_{MU}$ speeds can be established from free air data provided that the data are verified by ground takeoff tests. Certain safeguards are included in conjunction with the establishment of $V_R$ speeds to ensure that takeoffs in service can be made with consistent safety.

A change is being introduced to the provision in 4T.117a(b) concerning the manner in which the net takeoff flight path is obtained. In accordance with this provision as contained in SR-422A, the net takeoff flight path would have a negative slope throughout the acceleration segment. Since this segment usually represents level flight easily controlled by reference to the normal flight instruments, a significant reduction in the flight path's gradient would not be expected. For these reasons, the provision is being changed to permit an equivalent reduction in acceleration in lieu of a reduction in gradient.

Section 4T.117a(b) is being amended additionally by changing the value of gradient margin in the net flight path for two-engine airplanes from 1.0 percent to 0.8 percent. The value for four-engine airplanes remains 1.0 percent. Differentiation in gradient values in the net flight path between two and four-engine airplanes is consistent with the differentiation in the climb gradients for the takeoff, enroute, and approach stages of flight. Statistical analysis substantiates the specific reduction of the net flight path gradient to a value of 0.8 percent. Correlatively, a reevaluation of the climb gradients for twin-engine airplanes in the second segment takeoff and in the approach climb indicates that the respective values should be 2.4 percent and 2.1 percent and these changes are being made in 4T.120 (b) and (d).

A change is introduced in the conditions prescribed for meeting the climb gradient in the first segment takeoff climb (4T.120(a)), by changing the speed $V_2$ to the speed $V_{LOF}$. The intent of this requirement is to use the speed at which the airplane lifts off the ground. In SR-422 this speed was considered to be $V_2$; however, in SR-422A and in this regulation the speed $V_2$ is a higher speed which is reached at the end of the takeoff distance and no longer reflects the conditions pertinent to the first segment climb. In making this change consistent with relevant changes in SR-422A and in this regulation, no consideration has been given to the appropriateness of the minimum climb gradient values prescribed for the first segment climb. These are subject to alteration if results of further studies so indicate.

There is being introduced in this regulation the concept of "stopways," the definition of which is contained in item 5(b). Stopways have been used outside the United States in meeting the accelerate-stop distances in case of aborted takeoffs. They are considered to result in more practical operations. In order to ensure that they can be used without detrimental effects on safety, a provision is being included in 4T.115(d) requiring taking into account the surface characteristics of the stopways to be used in scheduling the accelerate-stop distances in the Airplane Flight Manual.

In conjunction with the introduction of stopways, there are changes being made in the definition of a "clearway" (item 5(a)). One of the changes is to specify that a clearway begins at the end of the runway whether or not a stopway is being used. Of the other changes, the most

significant one expresses the clearway in terms of a clearway plane and permits this plane to have an upward slope of 1.25 percent. In effect, this change will allow, in some cases, use of clearways which would not be allowed under the definition in SR–422A because of relatively small obstacles or slightly sloping terrain. (See also 40T.81(c) and 43T.11(c).)

There are also included in this regulation a number of minor, editorial, or clarifying changes.

Draft Release No. 58–1C included a proposal for expanding lateral obstacle clearances in the takeoff flight path. Studies indicate that some expanding lateral clearances are necessary for safety in operations with all turbine-powered airplanes. It appears, therefore, that an appropriate rule should be made applicable not only to airplanes certificated in accordance with this regulation, but also to those certificated in accordance with SR–422 and SR–422A. Accordingly, no change is being made in this regulation to the lateral obstacle clearance provisions, instead, a Notice of Proposed Rule Making is now being prepared to amend SR–422, SR–422A, and this regulation, to require expanding lateral obstacle clearances for all airplanes certificated thereunder.

This Special Civil Air Regulation is not intended to compromise the authority of the Administrator under section 4b.10 to impose such special conditions as are found necessary in any particular case to avoid unsafe design features and otherwise to ensure equivalent safety.

Interested persons have been afforded an opportunity to participate in the making of this regulation (24 F.R. 128), and due consideration has been given to all relevant matter presented.

This regulation does not require compliance until after August 29, 1959; however, since applicants for a type certificate for turbine-powered transport category airplanes may elect to show compliance with this regulation before that date, it is being made effective immediately.

In consideration of the foregoing, the following Special Civil Air Regulation is hereby promulgated to become effective immediately:

[Contrary provisions of the Civil Air Regulations notwithstanding, all turbine-powered transport category airplanes for which a type certificate is issued after August 29, 1959, shall comply with all of the following requirements, except that, turbopropeller-powered airplanes previously type certificated with the same number of reciprocating engines need only comply with the performance requirements of paragraph 2.] Applicants for a type certificate for a turbine-powered transport category airplane may elect and are authorized to meet the requirements of this Special Civil Air Regulation prior to August 29, 1959, in which case however, all of the following provisions must be complied with.

1. The provisions of Part 4b of the Civil Air Regulations, effective on the date of application for type certificate; and such of the provisions of all subsequent amendments to Part 4b, in effect prior to August 27, 1957, as the Administator finds necessary to ensure that the level of safety of turbine-powered airplanes is equivalent to that generally intended by Part 4b.

2. In lieu of sections 4b. 110 through 4b.125, 4b.183, and 4b.743 of Part 4b of the Civil Air Regulations, the following shall be applicable:

## PERFORMANCE

4T.110 *General.*

(a) The performance of the airplane shall be determined and scheduled in accordance with, and shall meet the minima prescribed by, the provision of sections 4T.110 through 4T.123. The performance limitations, information, and other data shall be given in accordance with section 4T.743.

(b) Unless otherwise specifically prescribed, the performance shall correspond with ambient atmospheric conditions and still air. Humidity shall be accounted for as specified in paragraph (c) of this section.

(c) The performance as affected by engine power and/or thrust shall be based on a relative humidity of 80 percent at and below standard temperatures and on 34 percent at and above standard temperatures plus 50° F. Between these two temperatures the relative humidity shall vary linearly.

(d) The performance shall correspond with the propulsive thrust available under the particular ambient atmospheric conditions, the particular flight condition, and the relative humidity specified in paragraph (c) of this section. The available propulsive thrust shall correspond with engine power and/or thrust not exceeding the approved power and/or thrust less the installational losses and less the power and/or equivalent thrust absorbed by the accessories and services appropriate to the particular ambient atmospheric conditions and the particular flight condition.

4T.111 *Airplane configuration, speed, power, and/or thrust; general.*

(a) The airplane configuration (setting of wing and cowl flaps, air brakes, landing gear, propeller, etc.), denoted respectively as the takeoff, en route, approach, and landing configurations, shall be selected by the applicant except as otherwise prescribed.

(b) It shall be acceptable to make the airplane configurations variable with weight, altitude, and temperature, to an extent found by the Administrator to be compatible with operating procedures required in accordance with paragraph (c) of this section.

(c) In determining the accelerate-stop distances, takeoff flight paths, takeoff distances, and landing distances, changes in the airplane's configuration and speed, and in the power and thrust shall be in accordance with procedures established by the applicant for the operation of the airplane in service, except as otherwise prescribed. In addition, procedures shall be established for the execution of balked landings and missed approaches associated with the conditions prescribed in sections 4T.119 and 4T.120(d), respectively. All procedures shall comply with the provisions of subparagraphs (1) through (3) of this paragraph.

(1) The Administrator shall find that the procedures can be consistently executed in service by crews of average skill.

(2) The procedures shall not involve methods or the use of devices which have not been proven to be safe and reliable.

(3) Allowance shall be made for such time delays in the execution of the procedures as may be reasonably expected to occur during service.

4T.112 *Stalling and minimum control speeds.*

(a) The speed $V_s$ shall denote the calibrated stilling speed, or the minimum steady flight speed at which the airplane is controllable, in knots, with:

(1) Zero thrust at the stalling speed, or engines idling and throttles closed if it is shown that the resultant thrust has no appreciable effect on the stalling speed;

(2) If applicable, propeller pitch controls in the position necessary for compliance with subparagraph (1) of this paragraph; the airplane in all other respects (flaps, landing gear, etc.) in the particular configuration corresponding with that in connection with which $V_s$ is being used;

(3) The weight of the airplane equal to the weight in connection with which $V_s$ is being used to determine compliance with a particular requirement;

(4) The center of gravity in the most unfavorable position within the the allowable range.

(b) The stall speed defined in this section shall be the minimum speed 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 chosen by the applicant, but not less than 1.2 $V_s$ nor greater than 1.4 $V_s$, and from a speed sufficiently above the stalling speed to ensure steady conditions, the elevator control shall be applied at a rate such that the airplane speed reduction does not exceed 1 knot per second.

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

(c) The minimum control speed $V_{MC}$, in terms of calibrated air speeed, shall be determined under the conditions specified in this paragraph so that, when the critical engine is suddenly made inoperative at that speed, it is possible to recover control of the airplane with the engine still inoperative and to maintain it in straight flight at that speed, either with zero yaw or, at the option of the applicant, with an angle of bank not in excess of 5 degrees. $V_{MC}$ shall not exceed 1.2 $V_s$ with:

(1) Engines operating at the maximum available takeoff thrust and/or power;

(2) Maximum sea level takeoff weight or such lesser weight as might be necessary to demonstrate $V_{MC}$.

(3) The airplane in the most critical takeoff configuration existing along the flight path after the airplane becomes airborne, except that the landing gear is retracted;

(4) The airplane trimmed for takeoff;

(5) The airplane airborne and the ground effect negligible;

(6) The center of gravity in the most unfavorable position;



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(d) In demonstrating the minimum speed specified in paragraph (c) of this section, the rudder force required to maintain control shall not exceed 180 pounds and it shall not be necessary to reduce the power and/or thrust of the operative engine(s).

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

4T.113 *Takeoff; general.*

(a) The takeoff data in sections 4T.114 through 4T.117 shall be determined under the conditions of subparagraphs (1) and (2) of this paragraph.

(1) At all weights, altitudes, and ambient temperatures, within the operational limits established by the applicant for the airplane.

(2) In the configuration for takeoff (see sec. 4T.111).

(b) Takeoff data shall be based on a smooth, dry, hard-surfaced runway and shall be determined in such a manner that reproduction of the performance does not require exceptional skill or alertness on the part of the pilot. In the case of seaplanes or float planes, the takeoff surface shall be smooth water, while for skiplane it shall be smooth, dry snow. In addition, the takeoff data shall include operational correction factors in accordance with subparagraphs (1) and (2) of this paragraph for wind and for runway gradients, within the operational limits established by the applicant for the airplane.

(1) Not more than 50 percent of nominal wind components along the takeoff path opposite to the direction of takeoff, and not less than 150 percent of nominal wind components along the takeoff path in the direction of takeoff.

(2) Effective runway gradients.

4T.114 *Takeoff speeds.*

(a) The critical-engine-failure speed $V_1$ in terms of calibrated air speed, shall be selected by the applicant, but shall not be less than the minimum speed at which controllability by primary aerodynamic controls alone is demonstrated during the takeoff run to be adequate to permit proceeding safely with the takeoff using average piloting skill, when the critical engine is suddenly made inoperative.

(b) The minimum takeoff safety speed $V_{2\,min}$, in terms of calibrated air speed, shall not be less than:

(1) 1.2 $V_s$ for two-engine [and three-engine] propeller-driven airplanes and for airplanes without propellers which have no provisions for obtaining a significant reduction in the one-engine-inoperative power-on stalling speed;

(2) 1.15 $V_s$ for propeller-driven airplanes having more than [three] engines and for airplanes without propellers which have provisions for obtaining a significant reduction in the one-engine-inoperative power-on stalling speed;

(3) 1.10 times the minimum control speed $V_{MC}$.

(c) The takeoff safety speed $V_2$, in terms of calibrated air speed, shall be selected by the applicant so as to permit the gradient of climb required in section 4T.120(b), but it shall not be less than:

**Miscellaneous Amendments**

**Adopted:** Apr. 13, 1954
**Effective:** May 18, 1954
**Published:** Apr. 20, 1954
(19 F.R. 2249)

A study of the administrative portions of Part 4b of the Civil Air Regulations indicates that they do not set forth in sufficient detail and clarity the scope of the part and the choice of regulations applicable to issuance of and changes in type certificates. This has caused some difficulty in the administration of the regulations with respect to these matters. This amendment is concerned mainly with setting forth clearly the scope of the part, section 4.0, and those regulations that are applicable to the issuance of and change to a type certificate. It also makes several other changes.

Although no basic change in policy from that followed in the past is contemplated, this amendment specifies in more detail the prerogatives of the applicant in choosing the regulations. It should be noted that the rules regarding the designation of applicable regulations, section 4b.11, apply not only to a new airplane type for which application for type certificate is made but also to all types irrespective of the date of original application for a type certificate. For example, the provisions which require, or which permit the applicant to elect, compliance with newer regulations would be effective not only to new type airplanes but also to all existing types certificated under this part. This provision in no way negates the long standing rule that, except in unusual cases, the airplane need not comply with any regulations made effective subsequent to the date of application for a type certificate. A significant clarification is being made which defines those changes in an airplane type which are sufficiently extensive to warrant treating it as a new type. Another important change is the establishment of a time limitation of 5 years for the effectiveness of an application for type certification. The amendments to the other administrative provisions, sections 4.12, 4.13, and 4.19, also include minor changes for purposes of clarification.

The presently effective regulations provide for the location of the pilot and his controls and instruments with respect to the plane of rotation of the propellers, etc. Since in certain instances the airworthiness regulations require flight crew personnel in addition to the pilot, these provisions (sections 4b.350, 4b.351, and 4b.353) are being amended to make them applicable to the minimum flight crew which is required for safe operation of the airplane.

Part 4b does not contain specific criteria for the installation of reversible propeller control systems. This amendment adds section 4b.407 which requires the application of the principle of fail-safe design to propeller reversing systems in newly certificated transport category airplanes. The intent of the rule is to preclude unwanted reversing of the propeller *during normal or emergency operation in case of a single failure or malfunction of the system.* It is also intended that single failures or malfunctions be considered in conjunction with manipulation of the controls by the pilot, and that failure of primary structural parts, the occurrence of which is expected to be extremely remote, need not be considered.

A change is being made to the requirements which establish the power supply needed for operation of equipment, systems, and installations during normal and power failure conditions. The change makes clear that the essential power load requirements under power failure conditions may be reduced in conjunction with a monitoring procedure and, for the two-engine-inoperative condition, permits taking into account for power supply requirements only those loads which are necessary for controlled flight.

Several additional changes of relatively minor nature are being made with the intent of clarifying the regulations.

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.

**Amendment made the following changes:**

(1) **Amended sections 4b.0, 4b.11, 4b.12, 4b.13, 4b.19, 4b.350, 4b.351, 4b.353, 4b.362, 4b.604, and 4b.606; and**

(2) **Added section 4b.407.**

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## Amendment 4b–2

**Miscellaneous Amendments**

**Adopted: July 20, 1955**
**Effective: Aug. 25, 1955**
**Published: July 26, 1955**
**(20 F.R. 5303)**

*This amendment includes a number of significant changes which are considered to represent* the initial step in the development of airworthiness requirements more specifically applicable to turbine-powered transport category airplanes. These entail revisions to the flight, structural, and powerplant installation provisions and in most cases are generally applicable to transport category airplanes, irrespective of the type of powerplant used. The most significant changes in the flight provisions which cater to turbine-powered airplanes deal with the establishment of limiting climb speeds for the all-engine-operating landing configuration in section 4b.119 and for the one-engine-inoperative approach configuration in section 4b.120. No limiting speeds are prescribed for these configurations in the currently effective regulations. In view of the fact that the best climb speeds for jet-powered airplanes might be considerably higher than the operational landing speed, these changes are designed to assure a reasonable relationship between the climb speeds and the landing speed. Other revisions of the flight provisions include changes in the take-off speed requirements of section 4b.114, in the trim requirements of sections 4b.141 and 4b.142, and in the stability requirements of sections 4b.154 and 4b.155.

Among the changes in the structural requirements is a new provision in section 4b.216(a) which is more specifically applicable to turbine-propeller-powered airplanes. It prescribes taking into account the high torque which might occur from possible unwanted feathering of a propeller under full power.

In addition there are other changes to the structural provisions which are generally applicable. These involve a requirement in new section 4b.216(d) which prescribes consideration of the unsymmetrical tail loads which might be caused by propeller drag as a result of possible time delay between engine failure and feathering of the propeller, a requirement in *section 4b.210(b)(4) allowing the applicant to limit* $V_c$ *at altitudes where* $V_d$ *is limited by* Mach number, and a requirement in section 4b.231(a) which prescribes an investigation of the landing gear for loads resulting from the higher contact speeds at altitudes and during downwind landings when the approval of landings above 5,000 feet or landings in downwinds exceeding 10 mph, respectively, is sought.

There are included amendments with respect to the installation of smoke detectors in cargo compartments. The currently effective rules in Part 4b require the installation of smoke detectors in cargo compartments "B", "C", and "D". In addition, the currently effective provisions in the air carrier operating parts of the Civil Air Regulations require, on all passenger airplanes with engines of over 600 horsepower, the installation of smoke detectors in "B" and "C" compartments. On the other hand, pending further development of reliable smoke detectors, Special Civil Air Regulation No. SR–401 permits noncompliance with the smoke detector provisions in Part 4b and in the operating parts of the regulations until April 1, 1956. This amendment revises sections 4b.383 (b)(2), (c)(1)(i), and (d), so that heat-type fire detectors may be installed in lieu of smoke detectors in compartments "B" and "C" and no detectors need be installed in compartments "D." Concurrently with this amendment, Parts 40, 41, and 42 are being amended so that heat-type fire detectors may be installed in lieu of smoke detectors in compartments "B" and "C."

A number of significant changes are included in connection with the powerplant installational requirements for the purpose of making them more specifically applicable to turbine-powered airplanes. In this regard changes are made to sections 4b.460, b4.480, b4.483, 4b.486, 4b.488, and 4b.490. These changes entail several new provisions designed mainly for the protection against fire in turbine powerplant installations. They include provisions against overflow of combustible fluids in the induction system, provisions which specify the compressor and accessory section of the turbine engine as designated fire zones, and provisions making certain requirements of the presently effective regulations for designated fire zones applicable to the combustion, turbine, and tail pipe sections.

In addition, section 4b.640 is being amended to incorporate a comprehensive and detailed set of standards intended to provide protection in types of icing conditions which might be reasonably anticipated during normal operations.

(1) The speed $V_{2\,min}$,

(2) The rotation speed $V_R$ (see paragraph (e) of this section) plus the increment in speed attained prior to reaching a height of 35 feet above the takeoff surface in compliance with section 4T.116(e).

(d) The minimum unstick speed $V_{MU}$, in terms of calibrated air speed, shall be the speed at and above which the airplane can be made to lift off the ground and to continue the takeoff without displaying any hazardous characteristics. $V_{MU}$ speeds shall be selected by the applicant for the all-engines-operating and the one-engine-inoperative conditions. It shall be acceptable to establish the $V_{MU}$ speeds from free air data: *Provided*, That these data are verified by ground takeoff tests.

NOTE: In certain cases, ground takeoff tests might involve some takeoffs at the $V_{MU}$ speeds.

(e) The rotation speed $V_R$, in terms of calibrated air speed, shall be selected by the applicant in compliance with the conditions of subparagraphs (1) through (4) of this paragraph.

(1) The $V_R$ speed shall not be less than:

(i) The speed $V_1$;

(ii) A speed equal to 105 percent of $V_{MC}$;

(iii) A speed which permits the attainment of the speed $V_2$ prior to reaching a height of 35 feet above the takeoff surface as determined in accordance with section 4T.116(e);

(iv) A speed which, if the airplane is rotated at its maximum practicable rate, will result in a lift-off speed $V_{LOF}$ (see paragraph (f) of this section) not less than 110 percent of $V_{MU}$ in the all-engines-operating condition nor less than 105 percent of $V_{MU}$ in the one-engine-inoperative condition.

(2) For any given set of conditions (weight, configuration, temperature, etc.), a single value of $V_R$ speed obtained in accordance with this paragraph shall be used in showing compliance with both the one-engine-inoperative and the all-engines-operating takeoff provisions.

(3) It shall be shown that the one-engine-inoperative takeoff distance determined with a rotation speed 5 knots less than the $V_R$ speed established in accordance with subparagraphs (1) and (2) of this paragraph does not exceed the corresponding one-engine-inoperative takeoff distance determined with the established $V_R$ speed. The determination of the takeoff distances shall be in accordance with section 4T.117(a)(1).

(4) It shall be demonstrated that reasonably expected variations in service from the takeoff procedures established by the applicant for the operation of the airplane (see sec. 4T.111(c)) (e.g., over-rotation of the airplane, out of trim conditions) will not result in unsafe flight characteristics nor in marked increases in the scheduled takeoff distances established in accordance with section 4T.117(a).

(f) The lift-off speed $V_{LOF}$, in terms of calibrated air speed, shall be the speed at which the airplane first becomes airborne.

4T.115 *Accelerate-stop distance.*

(a) The accelerate-stop distance shall be the sum of the following:

(1) The distance required to accelerate the airplane from a standing start to the speed $V_1$;

(2) Assuming the critical engine to fail at the speed $V_1$, the distance required to bring the airplane to a full stop from the point corresponding with the speed $V_1$.

(b) In addition to, or in lieu of, wheel brakes, the use of other braking means shall be acceptable in determining the accelerate-stop distance, provided that such braking means shall have been proven to be safe and reliable, that the manner of their employment is such that consistent results can be expected in service and that exceptional skill is not required to control the airplane.

(c) The landing gear shall remain extended throughout the accelerate-stop distance.

(d) If the accelerate-stop distance is intended to include a stopway with surface characteristics substantially different from those of a smooth hard-surfaced runway, the takeoff data shall include operational correction factors for the accelerate-stop distance to account for the particular surface characteristics of the stopway and the variations in such characteristics with seasonal weather conditions (i.e., temperature, rain, snow, ice, etc.), within the operational limits established by the applicant.

4T.116 *Takeoff path.* The takeoff path shall be considered to extend from the standing start to a point in the takeoff where a height of 1,500 feet above the takeoff surface is reached or to 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 section 4T.120(c) is shown, whichever point is at a higher altitude. The conditions of paragraphs (a) through (i) of this section shall apply in determining the takeoff path.

(a) The takeoff path shall be based upon procedures prescribed in accordance with section 4T.111(c).

(b) The airplane shall be accelerated on the ground to the speed $V_1$ at which point the critical engine shall be made inoperative and shall remain inoperative during the remainder of the takeoff. Subsequent to attaining speed $V_1$, the airplane shall be accelerated to speed $V_2$ during which time it shall be permissible to initiate raising the nose gear off the ground at a speed not less than the rotating speed $V_R$.

(c) Landing gear retraction shall not be initiated until the airplane becomes airborne.

(d) The slope of the airborne portion of the takeoff path shall be positive at all points.

(e) The airplane shall attain the speed $V_2$ prior to reaching a height of 35 feet above the takeoff surface and shall continue at a speed as close as practical to, but not less than, $V_2$ until a height of 400 feet above the takeoff surface is reached.

(f) Except for gear retraction and propeller feathering, the airplane configuration shall not be changed before reaching a height of 400 feet above the takeoff surface.

(g) At all points along the takeoff path starting at the point where the airplane first reaches a height of 400 feet above the takeoff surface, the available gradient of climb shall not be less than 1.2 percent

for two-engine airplanes, [1.5 percent for three-engine airplanes,] and 1.7 percent for four-engine airplanes.

(h) The takeoff path shall be determined either by a continuous demonstrated takeoff, or alternatively, by synthesizing from segments the complete takeoff path.

(i) If the takeoff path is determined by the segmental method, the provisions of subparagraphs (1) through (4) of this paragraph shall be specifically applicable.

(1) The segments of a segmental takeoff path shall be clearly defined and shall be related to the distinct changes in the configuration of the airplane, in power and/or thrust, and in speed.

(2) The weight of the airplane, the configuration, and the power and/or thrust shall be constant throughout each segment and shall correspond with the most critical condition prevailing in the particular segment.

(3) The segmental flight path shall be based on the airplane's performance without ground effect.

(4) Segmental takeoff path data shall be checked by continuous demonstrated takeoffs up to the point where the airplane's performance is out of ground effect and the airplane's speed is stabilized, to ensure that the segmental path is conservative relative to the continuous path.

NOTE: The airplane usually is considered out of ground effect when it reaches a height above the ground equal to the airplane's wing span.

4T.117 *Takeoff distance and takeoff run.*

(a) *Takeoff distance.* The takeoff distance shall be the greater of the distances established in accordance with subparagraphs (1) and (2) of this paragraph.

(1) The horizontal distance along the takeoff path from the start of the takeoff to the point where the airplane attains a height of 35 feet above the takeoff surface, as determined in accordance with section 4T.116.

(2) A distance equal to 115 percent of the horizontal distance along the takeoff path, with all engines operating, from the start of the takeoff to the point where the airplane attains a height of 35 feet above the takeoff surface, as determined by a procedure consistent with that established in accordance with section 4T.116.

(b) *Takeoff run. If the takeoff distance is intended to include* a clearway (see item 5 of this regulation), the takeoff run shall be determined and shall be the greater of the distances established in accordance with subparagraphs (1) and (2) of this paragraph.

(1) The horizontal distance along the takeoff path from the start of the takeoff to a point equidistant between the point where the speed $V_{LOF}$ is reached and the point where the airplane attains a height of 35 feet above the takeoff surface, as determined in accordance with section 4T.116.

(2) A distance equal to 115 percent of the horizontal distance along the takeoff path, with all engines operating, from the start of the takeoff to a point equidistant between the point where the speed $V_{LOF}$ is reached and the point where the airplane attains a height of 35 feet above

the takeoff surface, as determined by a procedure consistent with that established in accordance with section 4T.116.

4T.117a *Takeoff flight path.*

(a) The takeoff flight path shall be considered to begin at a height of 35 feet above the takeoff surface at the end of the takeoff distance as determined in accordance with section 4T.117(a).

(b) The net takeoff flight path data shall be determined in such a manner that they represent the airplane's actual takeoff flight paths, determined in accordance with section 4T.116 and with paragraph (a) of this section, reduced at each point by a gradient of climb equal to 0.8 percent for two-engine airplanes, [equal to 0.9 percent for three-engine airplanes,] and equal to 1.0 percent for four-engine airplanes. It shall be acceptable to apply the prescribed reduction in climb gradient as an equivalent reduction in the airplane's acceleration along that portion of the actual takeoff flight path where the airplane is accelerated in level flight.

4T.118 *Climb; general.* Compliance shall be shown with the climb requirements of sections 4T.119 and 4T.120 at all weights, altitudes, and ambient temperatures, within the operational limits established by the applicant for the airplane. The airplane's center of gravity shall be in the most unfavorable position corresponding with the applicable configuration.

4T.119 *All-engine-operating landing climb.* In the landing configuration the steady gradient of climb shall not be less than 3.2 percent, with:

(a) All engines operating at the power and/or thrust which are available 8 seconds after initiation of movement of the power and/or thrust controls from the minimum flight idle to the takeoff position;

(b) A climb speed not in excess of 1.3 $V_s$.

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

(a) *Takeoff; landing gear extended.* In the critical takeoff configuration existing along the flight path between the points where the airplane reaches the speed $V_{LOF}$ and where the landing gear is fully retracted, in accordance with section 4T.116 but without ground effect, the steady gradient of climb shall be positive for two-engine airplanes and shall not be less than [0.3 percent for three-engine airplanes, and not less than] 0.5 percent for four-engine airplanes, with:

(1) The critical engine inoperative, the remaining engine(s) operating at the available takeoff power and/or thrust existing in accordance with section 4T.116 at the time retraction of the airplane's landing gear is initiated, unless subsequently a more critical power operating condition exists along the flight path prior to the point where the landing gear is fully retracted;

(2) The weight equal to the airplane's weight existing in accordance with section 4T.116 at the time retraction of the airplane's landing gear is initiated;

(3) The speed equal to the speed $V_{LOF}$.

(b) *Takeoff; landing gear retracted.* In the takeoff configuration existing at the point of the flight path where the airplane's landing gear is fully retracted, in accordance with section 4T.116 but without ground effect, the steady gradient of climb shall not be less than 2.4 per-

cent for two-engine airplanes, [not less than 2.7 percent for three-engine airplanes,] and not less than 3.0 percent for four-engine airplanes, with:

(1) The critical engine inoperative, the remaining engine(s) operating at the available takeoff power and/or thrust existing in accordance with section 4T.116 at the time the landing gear is fully retracted, unless subsequently a more critical power operating condition exists along the flight path prior to the point where a height of 400 feet above the takeoff surface is reached;

(2) The weight equal to the airplane's weight existing in accordance with section 4T.116 at the time the airplane's landing gear is fully retracted;

(3) The speed equal to the speed $V_2$.

(c) *Final takeoff.* In the en route configuration, the steady gradient of climb shall not be less than 1.2 percent for two-engine airplanes, [not less than 1.5 percent for three-engine airplanes,] and not less than 1.7 percent for four-engine airplanes, at the end of the takeoff path as determined by section 4T.116, with:

(1) The critical engine inoperative, the remaining engine(s) operating at the available maximum continuous power and/or thrust;

(2) The weight equal to the airplane's weight existing in accordance with section 4T.116 at the end of the takeoff path.

(3) The speed equal to not less than 1.25 $V_s$.

(d) *Approach.* In the approach configuration corresponding with the normal all-engines-operating procedure such that $V_s$ related to this configuration does not exceed 110 percent of the $V_s$ corresponding with the related landing configuration, the steady gradient of climb shall not be less than 2.1 percent for two-engine airplanes, [not less than 2.4 percent for three-engine airplanes,] and not less than 2.7 percent for four-engine airplanes with:

(1) The critical engine inoperative, the remaining engine(s) operating at the available takeoff power and/or thrust;

(2) The weight equal to the maximum landing weight;

(3) A climb speed established by the applicant in connection with normal landing procedures, except that it shall not exceed 1.5 $V_s$ (see sec. 4T.111(c)).

4T.121 *En route flight paths.* With the airplane in the en route configuration, the flight paths prescribed in paragraphs (a) and (b) of this section shall be determined at all weights, altitudes, and ambient temperatures, within the operational limits established by the applicant for the airplane.

(a) *One engine inoperative.* The one-engine-inoperative net flight path data shall be determined in such a manner that they represent the airplane's actual climb performance diminished by a gradient of climb equal to 1.1 percent for two-engine airplanes, [1.4 percent for three-engine airplanes,] and 1.6 percent for four-engine airplanes. It shall be acceptable to include in these data the variation of the airplane's weight along the flight path to take into account the progressive consumption of fuel and oil by the operating engine(s).

(b) *Two engines inoperative.* [For airplanes with three or four engines, the two-engine-inoperative net flight path data shall be determined in such a manner that they represent the airplane's actual climb performance diminished by a gradient of climb equal to 0.3 percent for three-engine airplanes and equal to 0.5 percent for four-engine airplanes.] It shall be acceptable to include in these data the variation of the airplane's weight along the flight path to take into account the progressive consumption of fuel and oil by the operating engines.

(c) *Conditions.* In determining the flight paths prescribed in paragraphs (a) and (b) of this section, the conditions of subparagraphs (1) through (4) of this paragraph shall apply.

(1) The airplane's center of gravity shall be in the most unfavorable position.

(2) The critical engine(s) shall be inoperative, the remaining engine(s) operating at the available maximum continuous power and/or thrust.

(3) Means for controlling the engine cooling air supply shall be in the position which provides adequate cooling in the hot-day condition.

(4) The speed shall be selected by the applicant.

4T.122 *Landing distance.* The landing distance shall be the horizontal distance required to land and to come to a complete stop (to a speed of approximately 3 knots in the case of seaplanes or float planes) from a point at a height of 50 feet above the landing surface. Landing distances shall be determined for standard temperatures at all weights, altitudes, and winds, within the operational limits established by the applicant for the airplane. The conditions of paragraphs (a) through (g) of this section shall apply.

(a) The airplane shall be in the landing configuration. During the landing, changes in the airplane's configuration, in power and/or thrust, and in speed shall be in accordance with procedures established by the applicant for the operation of the airplane in service. The procedures shall comply with the provisions of section 4T.111(c).

(b) The landing shall be preceded by a steady gliding approach down to the 50-foot height with a calibrated air speed of not less than 1.3 $V_s$.

(c) The landing distance shall be based on a smooth, dry, hard-surfaced runway, and shall be determined in such a manner that reproduction does not require exceptional skill or alertness on the part of the pilot. In the case of seaplanes or float planes, the landing surface shall be smooth water, while for skiplanes it shall be smooth, dry snow. During landing, the airplane shall not exhibit excessive vertical acceleration, a tendency to bounce, nose over, ground loop, porpoise, or water loop.

(d) The landing distance data shall include operational correction factors for not more than 50 percent of nominal wind components along the landing path opposite to the direction of landing and not less than 150 percent of nominal wind components along the landing path in the direction of landing.

(e) During landing, the operating pressures on the wheel braking system shall not be in excess of those approved by the manufacturer

of the brakes, and the wheel brakes shall not be used in such a manner as to produce excessive wear of brakes and tires.

(f) In addition to, or in lieu, of, wheel brakes, the use of other braking means shall be acceptable in determining the landing distance, provided such braking means shall have been proven to be safe and reliable, that the manner of their employment is such that consistent results can be expected in service, and that exceptional skill is not required to control the airplane.

(g) If the characteristics of a device (e.g., the propellers) dependent upon the operation of any of the engines noticeably increase the landing distance when the landing is made with the engine inoperative, the landing distance shall be determined with the critical engine inoperative unless the Administrator finds that the use of compensating means will result in a landing distance not greater than that attained with all engines operating.

4T.123 *Limitations and information.*

(a) *Limitations.* The performance limitations on the operation of the airplane shall be established in accordance with subparagraph (1) through (4) of this paragraph. (See also sec. 4T.743.)

(1) *Takeoff weights.* The maximum takeoff weights shall be established at which compliance is shown with the generally applicable provisions of this regulation and with the takeoff climb provisions pre-

obstruction clearance plane and the runway. The weight of the airplane shall be assumed to be reduced by the weight of the fuel and oil expected to be consumed in flight to the airport of intended destination. Compliance shall be shown with the conditions of subparagraphs (1) and (2) of this paragraph. (See secs. 4T.123(b) and 4T.743(b).)

(1) It shall be assumed that the airplane is landed on the most favorable runway and direction in still air.

(2) It shall be assumed that the airplane is landed on the most suitable runway considering the probable wind velocity and direction and taking due account of the ground handling characteristics of the airplane and of other conditions (i.e., landing aids, terrain, etc.). If full compliance with the provisions of this subparagraph is not shown, the airplane may be taken off if an alternate airport is designated which permits compliance with paragraph (b) of this section.

(b) *Alternate airport.* No airport shall be designated as an alternate airport in a dispatch release unless the airplane at the weight anticipated at the time of arrival at such airport can comply with the provisions of paragraph (a) of this section, provided that the airplane can be brought to rest within 70 percent of the effective length of the runway.

4. In lieu of section 43.11 of Part 43 of the Civil Air Regulations the following shall be applicable.

43T.11 *Transport category airplane weight limitations.* The performance data in the Airplane Flight Manual shall be applied in determining compliance with the following provisions:

(a) No airplane shall be taken off at a weight which exceeds the takeoff weight specified in the Airplane Flight Manual for the elevation of the airport and for the ambient temperature existing at the time of the takeoff. (See secs. 4T.123(a)(1) and 4T.743(a).)

(b) No airplane shall be taken off at a weight such that, allowing for normal consumption of fuel and oil in flight to the airport of destination and to the alternate airports, the weight on arrival will exceed the landing weight specified in the Airplane Flight Manual for the elevation of each of the airports involved and for the ambient temperatures anticipated at the time of landing. (See secs. 4T.123(a)(2) and 4T.743(a).)

(c) No airplane shall be taken off at a weight which exceeds the weight at which, in accordance with the minimum distances for takeoff scheduled in the Airplane Flight Manual, compliance with subparagraphs (1) through (3) of this paragraph is shown. These distances shall correspond with the elevation of the airport, the runway to be used, the effective runway gradient, and the ambient temperature and wind component existing at the time of takeoff. (See secs. 4T.123(a)(3) and 4T.734(a).)

(1) The accelerate-stop distance shall not be greater than the length of the runway plus the length of the stopway if present.

(2) The takeoff distance shall not be greater than the length of the runway plus the length of the clearway if present, except that the length of the clearway shall not be greater than one-half of the length of the runway.

(3) The takeoff run shall not be greater than the length of the runway.

(d) No airplane shall be operated outside the operational limits specified in the Airplane Flight Manual. (See secs. 4T.123(a)(4) and 4T.743(a).)

5. The following definitions shall apply:

(a) *Clearway.* A clearway is an area beyond the runway, not less than 500 feet wide, centrally located about the extended center line of the runway, and under the control of the airport authorities. The clearway is expressed in terms of a clearway plane, extending from the end of the runway with an upward slope not exceeding 1.25 percent, above which no object nor any portion of the terrain protrudes, except that threshold lights may protrude above the plane if their height above the end of the runway is not greater than 26 inches and if they are located to each side of the runway.

NOTE: For the purpose of establishing takeoff distances and takeoff runs, in accordance with section 4T.117 of this regulation, the clearway plane is considered to be the takeoff surface.

(b) *Stopway.* A stopway is an area beyond the runway, not less in width than the width of the runway, centrally located about the extended center line of the runway, and designated by the airport authorities for use in decelerating the airplane during an aborted takeoff: To be considered as such, a stopway must be capable of supporting the airplane during an aborted takeoff without inducing structural damage to the airplane. (See also sec. 4T.115(d) of this regulation.)

(Pages 311 through 313 deleted by Supplement No. 1 dated February 1, 1963. Page 315 follows.)

There is also included an amendment which changes section 4b.740 so that each airplane need not be furnished with an Airplane Flight Manual if such a manual is not required by the operating parts of the Civil Air Regulations. Concurrently with this amendment, Parts 40, 41, and 42 are being amended to require the carriage of an approved Airplane Flight Manual only when the airplane does not carry an operators' manual containing all the information as required for the Airplane Flight Manual.

In addition to the foregoing substantive changes, there are included a number of miscellaneous minor changes most of which are editorial or of a clarifying nature.

Interested persons have been afforded an opportunity to participate in the making of this amendment (20 F.R. 339), and due consideration has been given to all relevant matter presented.

Amendment made the following changes:

(1) Amended sections 4b.1, 4b.114, 4b.119, 4b.120, 4b.141, 4b.142, 4b.154, 4b.155, 4b.210, 4b.212, 4b.216, 4b.221, 4b.226, 4b.231, 4b.356, 4b.373, 4b.383, 4b.386, 4b.401, 4b.404, 4b.417, 4b.418, 4b.420, 4b.460, 4b.480, 4b.481, 4b.483, 4b.484, 4b.486, 4b.487, 4b.488, 4b.489, 4b.490, 4b.610, 4b.612, 4b.632, 4b.634, 4b.640, 4b.643, 4b.712, 4b.732, and 4b.740, and the Notice under figure 4b–20;

(2) Deleted sections 4b.455, 4b.456, and 4b.457; and

(3) Added figures 4b–24a, 4b–24b, 4b–24c, 4b–25a, 4b–25b, and 4b–25c.

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## Amendment 4b–3

**Miscellaneous Amendments Resulting From the 1955 Annual Airworthiness Review**

Adopted: Feb. 7, 1956
Effective: Mar. 13, 1956
Published: Feb. 11, 1956 (21 F.R. 989)

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

With respect to the flight provisions, section 4b.112 is being amended to permit the use of the minimum speed attained during the stall demonstration in determining the required climb and section 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 parameter" in the gust load requirements.

In new section 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 section 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 section 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 section 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 section 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 section 4b.336 which establishes more up-to-date criteria for the selection of landing gear tires.

The currently effective requirements of section 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.

**Amendment made the following changes:**

(1) Amended sections 4b.104, 4b.112, 4b.160, 4b.202, 4b.210, 4b.211, 4b.212, 4b.213, 4b.215, 4b.216, 4b.230, 4b.231, 4b.232, 4b.235, 4b.306, 4b.320, 4b.324, 4b.332, 4b.336, 4b.337, 4b.358, 4b.386, 4b.413, 4b.414, 4b.420, 4b.421, 4b.424, 4b.430, 4b.431, 4b.435, 4b.437, 4b.451, 4b.604, 4b.637, 4b.643, 4b.711, 4b.718, and 4b.738, and figures 4b–1, 4b–3, 4b–8, 4b–9, 4b–10, and 4b–11; and

(2) Added sections 4b.234a and 4b.270.

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## Amendment 4b–4

**Position and Anticollision Light Requirements**

**Adopted:** Feb. 25, 1957
**Effective:** Apr. 1, 1957
**Published:** Mar. 1, 1957 (22 F.R. 1273)

The continuing increase in air traffic density and the advent of airplanes capable of appreciably higher speeds than heretofore attained demand further improvement in the exterior lighting of aircraft. The presently effective regulations in Part 4b of the Civil Air Regulations prescribe certain specifications for anticollision lights and, in addition, require the installation of a position light flasher and prescribe certain specifications for position lights.

The presently effective specifications for anticollision lights contained in section 4b.637 were established a few years ago. They were based upon conclusions reached from experimentation and studies conducted by both industry and government. The use on a relatively large number of aircraft of lights conforming to these specifications has revealed the need for further modification. Furthermore, during the past year or so experimentation has led to the development of condenser-discharge type lights which appear to have certain advantageous features. The inherent characteristics of such lights, however, do not permit compliance with certain of the specifications presently contained in section 4b.637. The Board considers that both incandescent and condenser-discharge lights have sufficient advantages to permit their use, provided that the design features essential in an effective anticollision light system are incorporated. Accordingly, section 4b.637 is being amended to include new specifications which establish in more detail the essential features of an anticollision light and which at the same time are sufficiently broad to permit the use of new lights currently under development.

Experience with anticollision lights has shown that the relatively high intensity of these lights may have a deleterious effect on the visibility of the position lights, particularly if the

latter are flashing. Apparently the flashing of wing and tail position lights, the fuselage lights, and the anticollision lights is conducive to confusion as regards the direction of flight. Tests have shown that with the presently used system the clearest indication is obtained when, in addition to the flashing anticollision light, the lighting system is limited to two wing lights and a white tail light, and when these three position lights are on steady. In view of the foregoing, the provisions of section 4b.632 which require fuselage lights, red tail light, and the flasher are being deleted. Concurrently with this amendment, Part 40 of the Civil Air Regulations is being amended to delete the provision for flashing position lights.

These new specifications for anticollision and position lights will be applicable to all transport category airplanes for which application for type certification is made after the effective date of this amendment. However, the new lighting system may be installed on current airplanes on a voluntary basis.

It is considered that these new requirements set forth necessary and sufficient conditions for anticollision light systems to provide a reasonable level of safety. However, since these requirements entail more conditions than have been required in the past, experience with them on individual airplanes might indicate the need for future revisions, particularly with respect to light intensities and coverage. Further, as current research and development programs progress, the question of color of the light might need reevaluation. The Board will consider any necessary changes as might be indicated by future developments.

Interested persons have been afforded as opportunity to participate in the making of this amendment (21 F.R. 3388), and due consideration has been given to all relevant matter presented.

**Amendment made the following changes:**

(1) **Amended sections 4b.632, 4b.634, and 4b.637, and figures 4b–18 and 4b–20; and**

(2) **Added figure 4b–27.**

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## Amendment 4b–5

**Emergency Evacuation Provisions**

**Adopted: Mar. 5, 1957**
**Effective: Apr. 9, 1957**
**Published: Mar. 9, 1957**
**(22 F.R. 1546)**

The presently effective emergency evacuation provisions contained in section 4b.362 of Part 4b of the Civil Air Regulations were adopted on November 15, 1951, and were considered appropriate for airplanes which were then in the design stage. Airplanes currently undergoing development are considerably larger in passenger capacity; consequently, the emergency evacuation provisions heretofore effective are considered in need of revision. Furthermore, experience with these requirements indicates a need for additional revision to make them more practicable for application to all airplanes subject to these provisions.

This amendment makes certain changes in the number, size, and location of emergency exits. Also, provision is made for a somewhat greater flexibility of application of these regulations. In addition, this amendment prescribes exit configurations for high-wing airplanes, and provides for evacuation means in case of unplanned ditching in water for all airplanes.

Pursuant to the provisions of section 4b.11(c) of Part 4b, an applicant for type certification may elect to show compliance with this amendment even though the date of application for type certification was made prior to the effective date of this amendment. However, it is considered that the provisions of section 4b.362 are so interrelated that if the applicant elects to show compliance with any portion of the section, he should be required to show compliance with the entire section.

Interested persons have been afforded an opportunity to participate in the making of this amendment (21 F.R. 7688), and due consideration has been given to all relevant matter presented.

**Amendment made changes in section 4b.362.**

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## Amendment 4b–6

**Miscellaneous Amendments Resulting From the 1956 Annual Airworthiness Review**

Adopted: July 8, 1957
Effective: Aug. 12, 1957
Published: July 16, 1957
(22 F.R. 5562)

There are contained herein amendments with respect to various issues stemming from the 1956 Annual Airworthiness Review.

Of the changes being made, the most extensive ones involve the powerplant provisions. Most of these are applicable to turbine engine installations. In this regard, there is included an amendment to section 4b.480 which designates as fire zones combustor, turbine, and tailpipe sections containing lines carrying flammable fluids or gases, but does not require the installation of a fire-extinguisher system in these sections if a fire occurring in any such sections can be demonstrated to be otherwise controlled. In addition, section 4b.485 is being amended to require fire detectors for all combustor, turbine, and tailpipe sections irrespective of whether they contain lines carrying flammable fluids or gases. The currently effective requirements specify the compressor and accessory sections of turbine engines as fire zones and make only certain provisions for fire zones applicable to the other sections. These changes should provide a reasonably high degree of fire protection for turbine powerplants.

Heretofore there have been no specific provisions in the regulations governing engine design for the protection against rotor blade failure. However, concurrently with this amendment Part 13 of the Civil Air Regulations is being amended to require that rotor cases be of such construction as to contain the damage resulting from rotor blade failure. In order to provide the necessary protection on airplanes which might use engines not incorporating this construction, there is included in new section 4b.401(d) a provision to require such protection in the powerplant installation.

Concurrently with this amendment Part 13 is also being amended to minimize the probability of turbine rotor failure by requiring additional design precautions in respect of the turbine wheel and the relevant engine control systems. In this regard, a requirement is included in new section 4b.401(e) to require design precautions in the powerplant installation to safeguard the airplane against turbine rotor failures when the airplane is equipped with engines not certificated in accordance with the criteria in the aforementioned amendment to Part 13.

There is also included a change to section 4b.604 which specifies the required instruments for turbine powerplants. No change is being made with respect to the instruments for reciprocating engines. The requirement for a reverse thrust indicator for turbopropellers specifies early indication instead of either early or late as implied in the currently effective provisions for reciprocating engines. In view of the characteristic operation of the turbopropeller in the ground fine and reverse pitch ranges, it is considered that an early indication would provide the more useful information to the pilots. The requirement for the reverse thrust indicator on turbojet installations specifies indication when the device is in the reverse position. It is intended to permit the use of either an early or a late indication. The Board considers that further study may be necessary on turbo-propeller installations utilizing reverse thrust power and on turbojet reverse thrust systems to determine whether a quantitative type of indicator should be required.

A new provision is being added (section 4b.408) which requires, on turbopropeller installations, the consideration of the single failure safety criterion in the design of propeller-drag limiting systems such as negative torque control systems and other backup systems. This provision is not intended to require consideration of more than one component failure in any one of the systems at any given time, either during normal or emergency operation; investigation of all components, whether or not integral with the engine, is required.

There are included herein changes which extend the currently effective provisions governing intermittent maximum icing conditions so as to cover conditions which might be critical insofar as the turbine engine induction system is concerned. In this regard, the data are being extended in accordance with NACA Technical Note 2738 and involve a revision of Figure 4b–25a to cover drop diameters as low as 15 microns and a revision of Figure 4b–25c to cover distances down to 0.3 mile. The icing conditions prescribed in the currently

*effective regulations are applicable in the main to the airframe. The changes being made* in section 4b.461 require the turbine powerplant to be subjected to the same icing conditions and require that the induction system be protected to prevent serious engine power loss. A similar requirement is incorporated with respect to certification of turbine engines by an amendment to Part 13 which is being made concurrently with this amendment.

Additional changes to the powerplant provisions include consideration of turbine engine torque, caused by sudden engine stoppage, in the structural design of the engine mount (see section 4b.216(a)(4)); of crash protection for fuselage fuel tanks (see section 4b.420(f)); and of safety criteria for fuel dumping systems (see section 4b.437(f)). It is considered that the storage of fuel in the fuselage section of the wing might pose serious fire hazards during a crash landing and, therefore, in order to minimize these hazards, the provisions in section 4b.420(e) require that fuselage fuel tanks withstand without leakage the inertia forces prescribed in the currently effective regulations for emergency landing conditions. It is not intended by this requirement to prescribe any particular type of fuel tank design.

With respect to section 4b.236 there is being included a more specific requirement to account for the unsymmetrical loads on multiple-wheel landing gears. A change is being made to section 4b.335(c) to permit greater flexibility in determining the required energy capacity for wheel brakes.

With respect to pressurization equipment and supply, section 4b.374 is being changed *to require that airplanes equipped with pressurization systems maintain, at the maximum* operating altitude under normal conditions, a cabin pressure altitude of not more than 8,000 feet and all airplanes certificated for operation above an altitude of 25,000 feet be able to maintain a cabin pressure altitude of not more than 15,000 feet in the event that any one pressurization system component becomes inoperative. In addition, the oxygen equipment requirements of section 4b.651 are being revised to make them more realistically applicable to airplanes which are intended to operate above 25,000 feet.

In addition, there are other less substantive changes being made with respect to personnel accommodations, emergency evacuation provisions, autopilot systems, etc. Further, 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 (21 F.R. 9217), and due consideration has been given to all relevant matter presented.

**Amendment made the following changes:**

(1) **Amended sections 4b.1, 4b.210, 4b.212, 4b.216, 4b.235, 4b.236, 4b.270, 4b.320, 4b.335, 4b.337, 4b.352, 4b.353, 4b.356, 4b.358, 4.362, 4b.371, 4b.374, 4b.401, 4b.420, 4b.435, 4b.437, 4b.440, 4b.460, 4b.461, 4b.474, 4b.480, 4b.483, 4b.484, 4b.485, 4b.604, 4b.605, 4b.612, 4b.613, 4b.622, 4b.631, 4b.640, 4b.645, and 4b.651, and figures 4b–11, 4b–25a, and 4b–25c; and**

(2) **Added new sections 4b.408 and 4b.474a.**

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**Amendment 4b–7**

**Instrument Installations**

**Adopted: Sept. 12, 1957**
**Effective: Oct. 17, 1957**
**Published: Sept. 19, 1957**
**(22 F.R. 7461)**

In 1953 the Civil Aeronautics Board promulgated section 4b.611(b) of Part 4b of the Civil Air Regulations and established a standard arrangement for the location on the instrument panel of required basic flight instruments. This amendment to section 4b.611(b) prescribes a new standard for the arrangement of basic flight instruments.

Studies made by representatives of the Government and industry indicated that the standard prescribed in section 4b.611(b) no longer reflects the optimum instrument arrangement, and does not provide the flexibility needed to include new instruments, or to integrate related instruments, which have been or may be developed in the future. Accordingly, a

proposal to replace the existing standard for flight instrument arrangement with a new one commonly referred to as the "Basic T" was published for comment in accordance with public rule making procedures and circulated as Civil Air Regulations Draft Release No. 57–5 on April 3, 1957.

In this draft release it was proposed to establish a "Basic T" arrangement consisting of a group of 6 instruments giving the following information: (1) speed, (2) attitude, (3) altitude, (4) flight path deviation, (5) direction, and (6) climb. However, after consideration of the comment received in response to the proposal and after further analysis of the problem, the Board has concluded that there are only 4, rather than 6, basic flight instruments that require a standard location on the instrument panel. The 4 instruments are those which present basic information as to air speed, attitude, altitude, and direction.

While it was originally proposed to establish standard positions for those instruments giving information as to flight path deviation and climb, it is believed such a proposal would make the standard so inflexible as to interfere with the possible integration of such instruments with the 4 basic instruments, and the use of newly developed instruments. Accordingly, this amendment prescribes standard positions on the instrument panel for only the 4 instruments which present basic information as to airspeed, attitude, altitude, and direction.

The concept of the "Basic T" involves more than location of specifically named instruments. The theory is that it will constitute a system by which various items of related flight information will be cataloged and placed in certain standard locations in all instrument panels, regardless of type or make of instruments used. In this manner the "Basic T" takes advantage of the new types of integrated instruments which display more than one item of flight information. It is apparent, however, that if the proposed standard is to be a standard in fact, one basic indication must be specified for each instrument position. This eliminates, for example, the possibility of airspeed being replaced by angle of attack under the theory that airspeed is no longer required except for navigational purposes. It appears to be generally agreed that the basic indication of position 1 is airspeed. In this location may be added related flight information such as Mach number and angle of attack. It also appears to be generally agreed that the basic indications for positions 2 and 3 are pitch and bank, and (barometric) altitude. Command signals for adjusting pitch or turning right or left may be added to the attitude instrument (pitch and bank) and similarly, terrain clearance information and rate of climb may be included in position 3 with the altimeter.

Some difference of opinion was registered by interested parties with respect to position 4, previously position 5 in Draft Release 57–5. This instrument has been labeled "direction," and is intended primarily for navigational information. Certain groups have contended that the basic indication for this location should be heading. Their reason is that heading is paramount in maintaining a course, or making good a desired track, and that a gyroscopically stabilized indication of heading logically belongs immediately below the attitude instrument where it can be read simultaneously with the attitude instrument for three-dimensional control of the airplane. Others, on the other hand, contend that there should be a choice left to the operator to place a display for heading, flight path deviation, or both in this location. The reasoning is that certain carriers desire to use an integrated instrument in this position which shows pictorially the airplane's position in reference to a desired track, but not a quantitative indication of heading.

In considering the above issue the Board takes cognizance of the fact that most air transports of today do not have installed a flight path director or steering computer. In these airplanes heading must be read continually to give significance to the signals received from radio navigation aids. Accordingly, heading is the basic indication to be required in position 4. However, with increased use of electronic computers and installation of instruments systems which include command signals to make good required flight tracks there will be less dependence upon heading, and it is possible, therefore, that in the future the basic indication required by the pilot to maintain a given track will not be heading. Consequently, the rule establishes that the number 4 position shall be that instrument which most effectively indicates direction of flight with the understandiing that the basic indication of this instrument shall be heading but that if future developments prove it feasible the basic indication of this instrument may be changed so long as it is demonstrated that it is the instrument which most effectively indicates direction of flight. It is believed that this solution is consonant with present and known future aircraft flight instrument systems and will at the same time provide sufficient flexibility to permit use of newer direction instruments if these prove more operationally feasible.

With respect to the specific location of the basic flight instruments, we believe that the attitude (bank and pitch) indicator is the keystone of any instrument arrangement, and should, therefore, be located in the central position on the panel, with the other basic instruments disposed around it. The indicator providing directional information is constantly monitored along with the attitude indicator, in order to provide continuous three-dimensional control of the flight path. Since directional information is associated with the longitudinal axis of the airplane, this instrument should be most naturally positioned centrally beneath the attitude indicator. Control of air speed and altitude are directly related to attitude, so their location laterally adjacent to the attitude indicator is a natural one.

Interested persons have been afforded an opportunity to participate in the making of this amendment (22 F.R. 2538), and due consideration has been given to all relevant matter presented.

**Amendment revised section 4b.611(b) and deleted figure 4b–23.**

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## Amendment 4b–8

**Miscellaneous Amendments Resulting From the 1957 Annual Airworthiness Review**

**Adopted:** Apr. 15, 1958
**Effective:** May 17, 1958
**Published:** Apr. 19, 1958 (23 F.R. 2590)

There are contained herein amendments with respect to various issues stemming from the 1957 Annual Airworthiness Review.

Of the substantive changes, there is a new requirement in section 4b.132(e) which establishes basic objective criteria to insure, for the all-engines-operating condition, adequate lateral control within the operating speed range and appropriate airplane response to control application in all stages of flight. The provisions up to this time did not prescribe any specific requirements in this respect. It is expected that this rule will result in a more effective evaluation of the airplane's lateral stability and controllability.

The fatigue evaluation provisions, although applicable to all of the flight structure, do not specify any loading conditions for vertical flight surfaces with respect to the fail safe strength criteria in section 4b.270(b). For completeness of these provisions, an addition to section 4b.270(b) is contained herein which sets forth ultimate loads, relative to the fail safe strength evaluation of vertical surfaces, in terms of the generally applicable unsymmetrical and maneuvering limit loading conditions now prescribed in the regulations. There is also a change to section 4b.236(c)(2) which prescribes vertical load factors necessary for defining more completely the unsymmetrical loads applicable in the taxying and ground handling conditions for landing gears of multiwheel units.

Currently effective regulations require trim tab controls to be irreversible unless the tab is properly balanced and is shown to be free from flutter. The regulations do not cover this design feature with respect to other trim devices such as adjustable stabilizers, etc. A change is contained herein to section 4b.322 to require that all trim control systems be free from drift or creep.

There are contained herein several important changes with respect to powerplants. New section 4b.409 requires an in-flight investigation of turbine powerplants with respect to stall, surge, flame-out, etc. Included also is a change to section 4b.435 which establishes more definite specifications for fuel system filtration. In addition, the powerplant operating limitation provisions in section 4b.718 are being revised to make them more specifically applicable to turbine powerplants.

There are included several changes to the provisions regarding personnel accommodations, emergency evacuation, and ditching. The most substantive one involves a change to section 4b.362(d) which would permit the substitution of 2 type IV exits in lieu of each required type III exit, when such exits are intended for ditching.

Changes are being made to the provisions dealing with the landing gear retraction system, section 4b.334(b); with altimeter static pressure source tolerances, section 4b.612(b)(5); and with markings of the airspeed indicator, section 4b.732. A new section 4b.659 is included which requires appropriate protection of the airplane against failure of

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high energy rotors when such rotors are incorporated in any equipment on the airplane. There is included an amendment to section 4b.603 which requires the incorporation of a maximum airspeed indicator if the airspeed limitations vary appreciably with altitude.

In addition, there are included other changes which are of a clarifying or editorial nature.

Interested persons have been afforded an opportunity to participate in the making of this amendment (22 F.R. 9116), and due consideration has been given to all relevant matter presented.

**Amendment made the following changes:**

(1) Amended sections 4b.1, 4b.132, 4b.236, 4b.270, 4b.322, 4b.334, 4b.358, 4b.362, 4b.435, 4b.603, 4b.612, 4b.651, 4b.718, 4b.732, 4b.741, and 4b.742; and

(2) Added sections 4b.409 and 4b.659.

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## Amendment 4b–9

**Supplemental Oxygen Requirements**

**Adopted:** Aug. 27, 1958
**Effective:** Sept. 1, 1958
**Published:** Aug. 30, 1958
(23 F.R. 6743)

The advent of turbine-powered airplanes with normal operating altitudes higher than has been the case with airplanes powered by reciprocating engines has made necessary a reconsideration of supplemental oxygen requirements. Following a study of this problem by representatives of the Government and industry, a proposal to amend the existing supplemental oxygen requirements of Part 4b and the operating rules was published in accordance with public rule making procedures and circulated as Civil Air Regulations Draft Release No. 58–7 dated March 27, 1958.

In this draft release it was proposed to consolidate all controls, instruments, and warning devices at a single location to permit all phases of monitoring and operation of the pressurization and oxygen systems by a single crewmember. However, after consideration of the comments received the Board has concluded that such requirement, while stating a desirable objective, would actually result in a potentially lower level of safety because of the added complexity that would result. With regard to warning devices, it was proposed also to require both visible and audible warnings to give alarm in the event of cabin depressurization. Comments received in this matter pointed out that, in contrast to past practice, airplanes in the next few years will almost certainly incorporate other audible warning devices that may operate at cruise altitude and require immediate conditioned response, and that confusion could result from providing too many such audible warnings. Considering these comments, the Board concluded that the current requirements in section 4b.375(f) provide for adequately effective warnings.

High rates of fuel consumption at low altitudes lead to the possible necessity for turbine-powered transport airplanes to cruise at altitudes that would require sustaining oxygen for all occupants for extended periods of time. This has emphasized a need for regulations as to the minimum quantity of oxygen which may be carried to insure adequate protection for the passengers. The quantities prescribed by the current requirements of section 4b.651 are generally conceded to be in excess of actual needs for sustenance. The new oxygen flow rates contained herein will provide a level of safety acceptable for sustaining purposes without reducing the quantity carried below a safe minimum.

Some difference of opinion was expressed concerning the provisions for oxygen in the altitude range above 25,000 feet where its main purpose is to prevent physical harm to the passengers following cabin depressurization. One position was that it would be adequate to apply the same prescription as proposed for sustaining oxygen. The opposing view was held that while this might be adequate for sustenance at altitudes above 25,000 feet it would not be satisfactory following cabin decompression at these altitudes because of the problem of removing nitrogen from the lungs, and that for this reason a greater quantity of oxygen should be prescribed. The problem associated with this view is that either the flow rate must be equivalent to the higher requirement throughout the altitude range, or

equipment must be provided to enable the oxygen system to differentiate between two situations. In weighing these opposing views, the Board took into consideration that the prescription in the regulation is a minimum value; that previous requirements, although prescribing a greater quantity of oxygen, have not accounted for overall system efficiency; that additional system complexity would decrease reliability; and that the objective of oxygen following a decompression is to prevent physical harm and not necessarily to provide passengers with the same amount of oxygen which would be available at sea level.

There was some expression of opinion that the flow rate provided for flight crewmembers was not adequate. In considering these opinions, the Board was not able to establish that the 5,000-foot equivalent provided by the prescription for demand-type equipment was unsatisfactory. Consideration was also given to the fact that the prescription is a minimum and that normal operating tolerances will invariably insure that a somewhat greater quantity is furnished. Since this prescription could result in the crew being unable to draw oxygen from the demand-type system while the cabin is pressurized, a requirement is being added that undiluted oxygen be available to the crew.

The provision for insuring that oxygen masks be immediately available to the users is believed to be proper in light of the problems associated with flight at these altitudes. The time available to begin breathing supplemental oxygen becomes less with increasing altitude due to the decrease in the period of useful consciousness. Thus the requirements for making the dispensing units available to the users become more severe as the maximum certificated altitude becomes higher.

A prescription is being added to define the quantity of oxygen to be made available for first-aid use. To avoid having to predict the pressure altitudes at which such will be used, the prescription is in terms of flow at standard temperature and pressure.

The provisions of this regulation require two outlets and units of oxygen-dispensing equipment in the washroom and in the lavatory.

The cabin attendants, in the course of their normal duties, may be at any place in the cabin at the time of depressurization. Since, at the normal cruising altitude of turbine-powered airplanes, sufficient time may not be available for the attendants to return to a designated oxygen station, it is necessary that either a portable oxygen supply be carried by each attendant or that sufficient additional outlets and units of dispensing equipment be immediately available throughout the cabin to insure that it will be attainable at all times. The likelihood of turbine-powered airplanes having to continue operations at flight altitudes requiring sustaining oxygen makes necessary the provision of portable oxygen equipment for cabin attendants in order to insure their mobility even though such equipment may not be required to satisfy the emergency descent provisions. To avoid, as much as possible, the problems associated with changing over from a spare outlet of the installed system to a portable unit, these portable units should have, to the degree practicable, a uniform distribution in the cabin. To provide for this, the portable oxygen units are required to be immediately available.

The proposal regarding means of determining delivery of oxygen to the dispensing units was intended to provide an indication that the oxygen system is in operation and that oxygen is being released from the storage containers to the distribution system. Determination of delivery to individuals, as in the past, by observation of the storage bags on the masks or similar type examinations is felt to be inadequate.

Interested persons have been afforded an opportunity to participate in the making of this amendment (23 F.R. 2229), and due consideration has been given to all relevant matter presented. In view of the imminence of operations to be conducted pursuant to this amendment, the Board finds that further notice and public procedure hereon would be contrary to the public interest and that this amendment may be made effective on less than 30 days' notice.

**Amendment made changes in section 4b.651 and deleted figure 4b–21.**

## Amendment 4b–10

**Cargo Compartment Classification "E" for All-Cargo Operations**

Adopted: Apr. 17, 1959
Effective: Apr. 23, 1959
Published: Apr. 23, 1959
(24 F.R. 3153)

The presently effective sections 4b.382 and 4b.383 of Part 4b of the Civil Air Regulations prescribe design conditions for the protection of cargo and baggage compartments against fire. These requirements classify compartments into "A," "B," "C," and "D."

Class "A" and "B" compartments are those which provide access to all parts of the compartment to permit the use of hand fire extinguishers. In addition, Class "B" compartments require that all contents therein can be moved by hand. Class "C" and "D" compartments do not have this accessibility. Instead, Class "C" compartments are required to have a fire-extinguishing system capable of effectively flooding the entire compartment. Class "D" compartments are those in which the volume of air and its flow are so limited as to cause suppression of fire as a result of oxygen depletion.

An air carrier engaged in the carriage of cargo exclusively recommended to the Civil Aeronautics Board an amendment of the existing regulations to provide an additional classification of cargo compartments more specifically applicable to bulk loading of the main cabin area of an airplane engaged in all-cargo operations. The carrier indicated that the weight and bulk of the cargo to be carried in the main cabin make its movement by the crew impractical. Furthermore, the loss of cargo space by providing accessibility to all parts of the compartment and its contents results in an unnecessary economic burden. For these reasons, it is not practical to classify the main cabin as either an "A" or "B" compartment. Classification as a "C" compartment, considering the relatively large volume of the cabin, makes it impractical to carry a sufficient quantity of fire-extinguishing agent to flood effectively the entire cabin. Due to the large volume of the cabin, compliance with the conditions set forth for Class "D" compartments also becomes extremely difficult because so much oxygen exists that prompt suppression of the fire through oxygen depletion is not attainable.

The Civil Aeronautics Board included a proposed change to the cargo and baggage compartment fire protection requirements of Part 4b in a notice of proposed rule making issued in Draft Release No. 58–1C, dated December 22, 1958. That proposal, although it appeared to cover the intent, did not define in detail the specific conditions applicable to bulk-loaded cabins. After further study and considering the comments on the draft release, it is found that setting forth specific conditions is necessary. Therefore, the amendment contained herein establishes a new Class "E" cargo compartment and prescribes the detailed design conditions applicable thereto.

An evaluation of Daily Mechanical Reports and air carrier incident reports disclosed that between 1951 and 1956 during 18,971,602 hours of passenger-carrying flight time there had been four inflight fires in baggage compartments. It was reported that one of these fires was attributed to the cargo coming in contact with a cockpit heater, one was caused by matches in a passenger's bag, and two resulted from baggage being loaded against unprotected light bulbs. Additionally, three fires, detected while loading passengers' baggage before departure, were found to be caused by matches in passengers' bags. During this same period, there were no incidents of fire in 572,443 hours of flight in all-cargo operations. In the period 1957–1958, one additional fire was reported in the Daily Mechanical Reports. The cause of this fire was found to have been due to baggage being placed against an unprotected light bulb.

It has been determined that this amendment will make fire prevention requirements for all-cargo aircraft more realistic, without any material reduction in safety. Accordingly, section 4b.383 of Part 4b of the Civil Air Regulations is being amended to provide for all-cargo operations the new Class "E" cargo compartment located in the main cabin of an airplane. Such compartment is required to be equipped with a smoke or fire detector system to warn the crew of smoke or fire, to be completely lined with fire-resistant material, to provide for control of ventilation by the crew within the compartment, and to provide means for excluding hazardous quantities of smoke, flames, or noxious gases from entering the flight crew's compartment. Furthermore, it requires that crew-emergency exits remain accessible under all loading conditions.

In conjunction with the establishment of Class "E" cargo compartments, section 4b.380(c) is being amended to provide protective breathing equipment for the crew when the aircraft contains such a compartment. Since the operating record reveals that heat sources in proximity to cargo constitute a fire hazard, section 4b.382 is also being amended to provide fire protection from sources of heat such as light bulbs, heater ducts, electrical appliances, and combustion heaters in all classes of compartments.

In addition to the foregoing, section 4b.383(b), applicable to "B" compartments, is being amended by deleting the requirement that while the aircraft is in flight a member of the crew must be able to move by hand all contents of the compartment. This deletion is considered to be consistent with the requirements for Class "A" and "E" compartments.

Interested persons have been afforded an opportunity to participate in the making of this amendment (24 F.R. 128), and due consideration has been given to all relevant matter presented. Since this amendment is relaxatory in nature and imposes no additional burden on any person, it may be made effective upon publication in the Federal Register.

**Amendment made changes in sections 4b.380, 4b.382, and 4b.383**

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## Amendment 4b–11

**Miscellaneous Amendments Resulting From the 1958 Annual Airworthiness Review**

**Adopted: Aug. 24, 1959**
**Effective: Oct. 1, 1959**
**Published: Sept. 1, 1959**
**(24 F.R. 7067)**

There are contained herein amendments as a result of the 1958 Annual Airworthiness Review.

The flight characteristics requirements are being amended to change the provisions relating to longitudinal trim and elevator control power. The currently effective regulations require sufficient elevator control power to fly the airplane at all speeds, powers, weights, and center of gravity positions for which the airplane is to be certificated. Transports of recent design are utilizing adjustable stabilizers and control power becomes a function of the stabilizer incidence setting. The amendments to sections 4b.112(c)(1), 4b.131(a), and 4b.151(a) are intended to make these provisions more appropriate for applications to adjustable stabilizers.

A number of changes to the structural provisions are being made. Section 4b.1 is being amended to include a definition of the term "zero fuel weight" which is frequently used in stating the structural limitations of an airplane. Amendments to sections 4b.210(b)(2), 4b.213(c), and figure 4b–2 are intended to eliminate possible inconsistencies in the relation between design speed $V_A$ and point $A$ on the maneuvering envelope, which resulted from previous amendments.

A proposal to reduce the required maneuvering load factor at the design dive speed $V_D$ was considered during the annual airworthiness review but is not being adopted at this time. Although previous operating statistics show that the probability of attaining a 2.5 load factor is less at speed $V_D$ than it is at lower speeds, there has been relatively little operating experience on turbine transports for which the cruising speed is closer to $V_D$. The proposal will be kept under study as operating statistics are obtained on turbine transports.

Section 4b.216(a) is being amended to specify engine torque loads appropriate for turbine engine installations. A new section 4b.217 is being added to specify strength criteria for speed control devices used in flight. Changes to sections 4b.231, 4b.235, and 4b.236 provide more rational ground load requirements relating to coefficients of friction and deflated tire conditions.

A change to section 4b.421(a) requires structural test or analysis of the fuel tanks when subject to pressure developed under the most adverse condition of airplane roll and fuel load. On the basis of past experience, section 4b.421(c) is being revised to require nonmetallic tanks to be tested only for the vibration test of section 4b.421(b)(4), since this has been found to be the critical condition, except that compliance may be shown based on satisfactory operating experience with a similar tank in a similar installation.

With respect to design and construction, a number of changes are being made. On some high-speed airplanes, it is likely that control surface dampers will be necessary in order to show compliance with the flutter prevention requirements. Therefore, section 4b.308 is being revised to provide that it shall be possible to continue safe flight even though a single failure occurs in the flutter damper system. Section 4b.320 is being amended to include design safety criteria for power-operated control systems. This amendment is intended to insure continued safe flight and landing in the event certain failures occur in the control system and in the case of engine failure.

Section 4b.352 is being amended to specify which portion of the windshield is affected by the bird impact strength requirements and which portion is affected by the fragmentation requirements.

To provide appropriate emergency exit requirements for small transports section 4b.362(c) is being amended to require at least one type IV exit on each side of the fuselage for a passenger capacity of up to 10 persons. A corresponding change is being made in the ditching exit requirements of section 4b.362(d).

In the powerplant installation requirements, section 4b.407 is being amended to extend the "fail-safe" concept to all types of thrust reversing systems intended for ground and/or inflight use. Sections 4b.410 and 4b.413 are being revised to simplify and clarify the statement of the fuel system and fuel flow requirements. Related changes to section 4b.430 clarify the definitions of main and emergency fuel pumps, delete the requirements that one pump for each engine must be engine driven, and eliminate the requirement for a bypass on fuel injection pumps for turbine engines.

Other amendments require cooling tests for turbine engine installations and means to indicate the functioning of the powerplant ice protection system.

A proposal to require the ability to regain full power or thrust within 20 seconds after engine malfunctioning occurs due to depletion of fuel in any tank was considered during the annual airworthiness review, but is not being adopted at this time. The objective of this proposal was to minimize the possibility of turbine engine flame-out during fuel tank switching. However, since there are several methods of accomplishing this objective, including systems designed to prevent such engine malfunctioning, further study is being given to this subject.

Other proposals being deferred for further study concern turbojet reverse thrust controls, the fire resistance of turbine engine installation diaphragms, and a means to indicate a clogged fuel filter condition (i.e., bypass operation) to the flight crew. The proposal on reverse thrust controls would have deleted the provision requiring a means to prevent inadvertent movement to a reverse thrust position, for systems which are approved for use in flight. Such systems are still in the development stage and additional evaluation is considered necessary to determine whether the previous proposal or some other change is appropriate. The proposal to permit fire-resistant in lieu of fire-proof diaphragms in certain turbine engine installations will be considered along with other changes in the powerplant fire protection requirements to make them suitable for isolated pod installations. The value of inflight indication of fuel filter clogging has been questioned in view of the fact that automatic filter bypass provisions cannot be controlled in flight and the military services are developing devices to indicate the occurrence of bypassing to maintenance personnel who can then service the filters.

Section 4b.603 is being amended to incorporate current terminology for flight and navigational instruments. However, a proposal which would require all critical airspeed limitations that vary with altitude to be displayed on the appropriate instrument is being deferred for further study. Where a number of such limitations exist, that proposal might be impractical or lead to confusion or undesirable differences in displaying airspeed limitations to pilots. At present, $V_{NE}$ is the only variable limit required to be indicated. A machmeter is being required for airplanes having compressibility limitations which are not otherwise indicated to the pilot in accordance with section 4b.732.

Section 4b.612 is being revised to clarify the power failure indicating means required for certain instruments. Section 4b.625 is being amended to cover new types of storage batteries as well as the conventional lead-acid types. A new section 4b.628 establishes criteria intended to minimize the hazards of lightning strikes on portions of the airplane which are insulated from the main airframe.

Another new section 4b.647 requires all new type transport category airplanes to be provided with individual flotation means for each occupant even though the airplane is not

certificated for ditching. The requirement that life preservers shall be reversible is being deleted from section 4b.645(d), since it is expected that design features and instructions to insure correct donning will be covered in the appropriate Technical Standard Order. Since chunks of ice falling from aircraft have caused hazards to persons and property on the ground, a new section 4b.660 requires that fluid drains be designed to prevent the formation of ice on the airplane. A placard showing the airspeed limitations for various flap settings is being required because these limitations are no longer shown on the airspeed indicator.

Interested persons have been afforded an opportunity to participate in the making of this amendment (24 F.R. 128), and due consideration has been given to all relevant matter presented.

**Amendment made the following changes:**

(1) **Amended sections 4b.1, 4b.112, 4b.131, 4b.151, 4b.210, 4b.213, 4b.216, 4b.231, 4b.235, 4b.236, 4b.308, 4b.320, 4b.352, 4b.362, 4b.407, 4b.410, 4b.413, 4b.415, 4b.421, 4b.430, 4b.461, 4b.483, 4b.603, 4b.612, 4b.613, 4b.625, 4b.632, 4b.645, and 4b.738, and figure 4b–2;**

(2) **Deleted sections 4b.414 and 4b.431; and**

(3) **Added sections 4b.217, 4b.455, 4b.628, 4b.647, and 4b.660.**

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## Amendment 4b–12

**Miscellaneous Amendments Resulting From the First Federal Aviation Agency Airworthiness Review**

**Adopted:** Mar. 27, 1962
**Effective:** May 3, 1962
**Published:** Mar. 30, 1962 (27 F.R. 2986)

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 section 4b.160(c)(1) for consistency with the trim condition applicable to the stall speed in present section 4b.112(c)(1). The proposed amendment to section 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, section 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 sections 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, section 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 section 4b.150 through section 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 section 4b.151(a), has been changed merely to reflect the new speed nomenclature prescribed by the addition of section 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 section 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, sections 4b.150–1 and 4b.151–1 are being deleted together with the discussion of policies relating thereto, as well as sections 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 sections 4b.157–1(e)(3), (e)(4), and (f)(2) are being deleted because they are in conflict with the provisions of section 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 section 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 (section 4b.714(c)), and to cover en route flap conditions (section 4b.212(b)). Nevertheless, the single flap design speed concept has been retained in sections 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, section 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 sections 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 section 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, section 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 injure 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, section 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 section 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 section 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 section 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 (section 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 section 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 section 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 acceptance means of compliance which would replace section 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 section 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, section 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, sections 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 section 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 section 4b.307(a) still applies, since this factor is intended for another purpose.

The upper aisle width specified in section 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 section 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 section 4b.385 remains unchanged. Section 4b.412 dealing with pressure crossfeed lines is being deleted because sections 4b.370 and 4b.385 cover both the fire control and ventilation aspects of section 4b.412.

As a result of comments received, the specific provisions regarding demonstrations or tests are being deleted from sections 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 sections 4b.15 and 4b.16. The flight conditions specified in section 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 section 4b.416, as proposed in the draft release are being transferred to a new paragraph (c) under section 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 section 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 section 4b.413 eliminate the horsepower basis for establishing flow rate, section 4b.415 is being deleted.

Because of the change made to section 4b.416, material contained in other sections is no longer necessary. Therefore, sections 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 section 4b.416.

In addition to the matter of unusable fuel supply, another question has arisen relating to the flow requirements of section 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 sections 4b.450 through 4b.455 deal with the powerplant cooling capability and specify test to show that powerplant temperature limits can be maintained. With the exception of section 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 sections 4b.453 and 4b.455 unnecessary. Accordingly, they are being deleted.

Consistent with the proposed changes to the powerplant cooling requirements, sections 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 sections 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 section 4b.488. Accordingly, this section is being deleted. Consistent with this deletion, editorial changes are being made in sections 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 section 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, section 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 section 4b.622(b).

Presently effective section 4b.652 deals with the reliability of engine-driven accessories and section 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 section 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 section 4b.656, concerning hydraulic system tests. Therefore, the proposed addition of section 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 air-speed 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 (sections 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 (section 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 section 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 $V_{FC}$ for certain stability characteristics. The speed margin between design speeds $V_C$ and $V_D$ in section 4b.210 is being replaced by a cross reference to section 4b.711.

*To minimize overspeeding due to pilot preoccupation, section 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 air-speed limitations require corresponding changes, including deletions and additions in sections 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 sections 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 section 4b.11(b) consideration of provisional type certificates. While it was proposed that this be accomplished by a note, it now appears that is is more appropriate to include such a provision within section 4b.11(b) rather than as a note thereto. Furthermore, the proposed section 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.

**Amendment made the following changes:**

(1) Amended sections 4b.1, 4b.11, 4b.130, 4b.131, 4b.132, 4b.141, 4b.142, 4b.150, 4b.151, 4b.152, 4b.153, 4b.154, 4b.155, 4b.156, 4b.157, 4b.157–1, 4b.158, 4b.160, 4b.210, 4b.212, 4b.216, 4b.221, 4b.235, 4b.270, 4b.306, 4b.306–1, 4b.307, 4b.329–2, 4b.329–6, 4b.334, 4b.352, 4b.358, 4b.362, 4b.371, 4b.413, 4b.416, 4b.418, 4b.420, 4b.435, 4b.436, 4b.440, 4b.447, 4b.450, 4b.451, 4b.452, 4b.484, 4b.484–1, 4b.487, 4b.603, 4b.604, 4b.612, 4b.612–4, 4b.622, 4b.624, 4b.627, 4b.642 4b.643, 4b.645, 4b.711, 4b.714, 4b.718, 4b.730, 4b.740–1, and 4b.741, and figure 4b–19;

(2) Deleted sections 4b.150–1, 4b.151–1, 4b.152–1, 4b.153–1, 4b.154–1, 4b.155–1, 4b.357, 4b.412, 4b.415, 4b.416–1, 4b.416–2, 4b.418–1, 4b.426–1, 4b.440–1, 4b.450–1, 4b.452–1, 4b.453, 4b.453–1, 4b.454–1, 4b.455, 4b.465, 4b.465–1, 4b.488, 4b.652, 4b.659, and 4b.712; and

(3) Added sections 4b.191 and 4b.271.

## Amendment 4b-13

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| Turboprop Conversions of Transport Category Airplanes | Adopted: | December 20, 1962 |
| | Effective: | December 20, 1962 |
| | Published: | December 29, 1962 (27 F.R. 12925) |

Special Civil Air Regulation No. SR-423 effective December 20, 1957, terminates on December 20, 1962. The purpose of this amendment to Part 4b is to incorporate the substance of SR-423 permanently into the Civil Air Regulations. SR-423 permits the type certification of turboprop airplanes, which previously were type certificated with the same number of reciprocating engines, without requiring compliance with all of the applicable requirements of the Civil Air Regulations effective on the date of application for the type certificate for the turboprop version. This amendment affects applicants for a type certificate for a turboprop conversion.

Section 4b.11(e) of Part 4b of the Civil Air Regulations provides that a change to engines employing different principles of operation or propulsion requires the issuance of a new type certificate based upon compliance with the regulations, together with all amendments thereto, effective on the date of the new application. A change from reciprocating engines to turboprop engines is a change to engines employing different principles of operation. Compliance with all the latest requirements of Part 4b would therefore be required for the type certification of a turbopropeller-powered transport category airplane previously certificated with the same number of reciprocating engines. Based, however, upon the belief that compliance with the latest requirements of Part 4b for such airplanes might be burdensome, impractical and not essential to safety, SR-423 was adopted in December of 1957 as a relaxation of the requirements of Part 4b. SR-423 permits the certification of turbopropeller-powered airplanes upon the showing of compliance with the airworthiness provisions applicable to the airplane as type certificated with reciprocating engines, together with certain later provisions of the Civil Air Regulations in effect on the date of application for a new or supplemental type certificate which are applicable or related to the powerplant of the turbopropeller-powered version. In addition, under the provisions of SR-423, transport category airplanes with turboprop replacements are required to comply with only the certification performance requirements of SR-422.

By its own terms, SR-423 terminates on December 20, 1962. The preamble to that regulation states, however, that at the end of its period of effectiveness the regulation would be evaluated for the purpose of considering the incorporation of the substance of its rules in the permanent body of the Civil Air Regulations. In this connection, the Federal Aviation Agency is aware that there is a continuing interest within the industry in the installation of turbopropeller-powered engines on airplanes presently equipped with reciprocating engines and that compliance with the latest provisions of Part 4b for such installation would be burdensome. Furthermore, experience has shown that the provisions of SR-423 provide an adequate level of safety for the airplanes certificated thereunder and that compliance with all of the latest requirements of Part 4b is not essential in the interest of safety for the certification of transport category airplanes with turboprop replacements. The Agency believes, therefore, that the substance of the provisions of SR-423 should be incorporated permanently into the Civil Air Regulations.

In order to accomplish the foregoing, section 4b.11(e)(2) is amended by deleting the words "operation or". Thus the provisions of that section are made applicable only to a change to engines employing different principles of propulsion. Since reciprocating and turboprop engines employ the same principles of propulsion, airplanes involving a conversion from reciprocating to the same number of turboprop engines will not be affected by the requirement for a new type certificate. Furthermore, to make the provisions presently set forth in SR-423 explicitly applicable to such airplanes, they are being incorporated into a new paragraph (f) under section 4b.11.

Consistent with the provisions of SR-423, this amendment requires that turboprop airplanes which were previously type certificated with the same number of reciprocating engines shall comply only with the certification performance requirements prescribed in Special Civil Air Regulation SR-422B. Therefore, a concurrent amendment is being made to SR-422B to limit the applicability of that regulation, with respect to turboprop airplanes which were previously type certificated with the same number of reciprocating engines, to compliance with the certification performance requirements set forth therein.

Since this amendment extends the provisions of a current regulation, and imposes no additional burden upon any person, compliance with the notice and public procedure provisions of the Administrative Procedure Act is unnecessary, and good cause exists for making it effective on less than 30 days' notice.

**Amendment revised section 4b.11 by deleting the words "operation or" from paragraph (e)(2), and by adding a new paragraph (f).**

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