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Section 1

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TITLE 14—CIVIL AVIATION

REPRINTING UNDER NEW NUMBERING SYSTEM

Title 14 has been extensively renumbered in the Code of Federal Regulations, 1949 Edition, in order to conform it to the system prescribed by the Regulations of the Administrative Committee of the Federal Register (13 F. R. 5929). Future amendments will be published under the new numbers. The currently effective text of Title 14, therefore, has been renumbered under the new system and reprinted below. All amendments which have been published in the FEDERAL REGISTER through June 30, 1949, and which are still in effect, have been incorporated in this reprint. The numbering of amendments published between June 30, 1949, and the date of this issue is explained in a note following the reprint.

This reprint was prepared by the Division of the Federal Register and individually approved by the Civil Aeronautics Board and the Civil Aeronautics Administration as to the text of their respective materials.

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Secretary,
Civil Aeronautics Board.
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Administrator of Civil Aeronautics.

Chapter I—Civil Aeronautics Board

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Part II of this issue is divided into two sections. Section 1 contains Chapter I, Parts 1–302, of Title 14, and Section 2 contains Chapter II, Parts 405–635.

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PART 1—AIRWORTHINESS CERTIFICATES

CROSS REFERENCE: For Aircraft Registration Certificates, see Part 501 of this title.

AIRWORTHINESS CERTIFICATES

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AIRWORTHINESS CERTIFICATE RULES

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AUTHORITY: §§ 1.1 to 1.24 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply sec. 603, 52 Stat. 1009; 49 U. S. C. 553.

SOURCE: §§ 1.1 to 1.24 contained in Amendment 131, Civil Air Regulations, 6 F. R. 5037, except as noted following sections affected. Redesignated by SR-327, 13 F. R. 5486.

AIRWORTHINESS CERTIFICATES

§ 1.1 *Application.* Application for an airworthiness certificate may be made by the registered owner of any aircraft registered as an aircraft of the United States upon the applicable form prescribed by the Administrator.

[Amdt. 131, 6 F. R. 5037, as amended by Amdt. 01-2, 12 F. R 949]

§ 1.2 *Requirements for issuance.* Prior to the issuance of an airworthiness certificate, the subject aircraft shall be inspected by a duly authorized representative for the Administrator to determine whether it is in condition for safe operation and complies with the airworthiness requirements specified in this subchapter: *Provided,* That an airworthiness certificate may be issued for an aircraft for which no such certificate has previously been issued and which has been manufactured under type certificate or under a type and a production certificate if the applicant for such certificate, upon request, presents to a duly authorized representative for the Administrator a Statement of Conformity properly executed by the maufacturer of the aircraft on a form prescribed by the Administrator, and if the aircraft satisfactorily passes an inspection made to determine whether such aircraft is in condition for safe operation: *Provided further,* That an aircraft manufactured under a type certificate only shall undergo, and an aircraft manufactured under a type and a production certificate may be required to undergo, an inspection to determine whether such aircraft conforms to the type certificate under which it is manufactured.

[Amdt. 131, 6 F. R. 5037, as amended by Amdt. 01-2, 12 F. R. 949]

§ 1.3 *Transferability.* An airworthiness certificate and the attached currently effective Aircraft Operation Record, upon transfer of ownership, shall remain with the aircraft for which they were issued.

AIRWORTHINESS CERTIFICATE RULES

§ 1.20 *Display.* An airworthiness certificate shall be carried at all times in the aircraft for which such certificate has been issued, and shall be presented upon the request of any duly authorized representative for the Administrator or Board, or any State or municipal official charged with enforcing local laws or regulations involving Federal compliance.

§ 1.21 *Cancellation.* An airworthiness certificate may be canceled upon the written request of the registered owner of the aircraft.

§ 1.22 *Surrender.* Upon the cancellation, suspension, revocation, or expiration of an aircraft airworthiness certificate the owner of the aircraft shall, upon request, surrender such certificate to any officer or employee of the Administrator.

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PART 2—TYPE AND PRODUCTION CERTIFICATES

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TYPE AND PRODUCTION CERTIFICATE RULES

AUTHORITY: §§ 2.1 to 2.36 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply sec. 601, 52 Stat. 1007; 49 U. S. C. 551.

SOURCE: §§ 2.1 to 2.36 contained in Amendment 02-0, Civil Air Regulations, 11 F. R. 7032, except as noted following section affected. Redesignated by SR-327, 13 F. R. 5486.

NOTE: Amendment 02-0, Civil Air Regulations, June 11, 1946, effective July 1, 1946, 11 F. R. 7032, provides as follows:

The Civil Aeronautics Board is authorized under section 609 of the Civil Aeronautics Act of 1938 (sec. 609, 52 Stat. 1011; 49 U. S. C. 559) to suspend or revoke type and production certificates. The Administrator, under the same section of the act, is authorized in cases of emergency to suspend such certificates in whole or in part for a limited period. In so doing he is required to notify immediately the holder and file a complaint with the Board, in which proceeding the holder is entitled to a hearing.

Certificates may be suspended if the interest of the public so requires, or may be revoked for any cause which at the time of revocation would justify the Administrator in refusing to issue to the holder a like certificate. Any deliberate misrepresentation in the application or in the submission of any information accompanying the application, or in any statement or report required of a certificate holder under these regulations, may be grounds for the suspension or revocation of a certificate.

In addition to the above grounds, production certificates may be suspended or revoked for any of the following reasons:

1. Willful violation on the part of the manufacturer of any portion of the Civil Aeronautics Act or any regulation promulgated thereunder relating to the production of articles authorized by the production certificate.
2. Demonstration of incompetency, carelessness or negligence, or the willful use of inferior or improper materials in the manufacture of articles covered by the certificate.
3. Failure of the manufacturer to maintain adequate facilities and personnel to assure the airworthiness and conformity of articles produced.
4. Refusal of the manufacturer to submit to inspection upon proper demand by a representative of the Administrator, or to render any reasonable assistance in connection therewith.

GENERAL

§ 2.1 *Definition.* The term "product" as used in this part shall mean:

(a) An aircraft,
(b) An aircraft engine,
(c) A propeller, or
(d) Any appliance specified in the Civil Air Regulations as eligible for a type or production certificate.

TYPE CERTIFICATES

§ 2.10 *Application.* The application for a type certificate for a specified product shall be made upon a form prescribed and furnished by the Administrator.

§ 2.11 *Requirements for issuance.* (a) The applicant shall submit with the application, or within a reasonable time thereafter, such drawings and other technical data concerning the design, material, specifications, construction, and performance of the product as may be required by the Administrator to show compliance with the pertinent parts of this subchapter.

(b) A product or components thereof shall be subjected to such tests as the Administrator may prescribe, consistent with the pertinent parts of this subchapter.

(c) One article of the product shall be completed prior to the issuance of a type certificate, and shall meet such standards as are required by the pertinent parts of this subchapter.

§ 2.12 *Duration.* A type certificate shall remain in effect until such time as it is canceled, suspended, revoked, or a termination date is fixed by the Board.

§ 2.13 *Transferability and licensing.* A type certificate is transferable, and the benefits of such certificate may be extended by licensing arrangements. In the event of any transfer or licensing arrangement the person making the transfer or granting the license shall immediately notify the Administrator in writing. Upon the termination of any licensing arrangement the grantor of the license shall immediately notify the Administrator in writing.

PRODUCTION CERTIFICATES

§ 2.20 *Application.* (a) The application for a production certificate shall be made upon a form prescribed and furnished by the Administrator and shall specify only a product for which a type certificate has been issued.

(b) The application shall be accompanied by a report which will include at least the following:

(1) A description of the manufacturing lay-out and production flow,

(2) A listing and description of any special processes required by the design of the product to be manufactured,

(3) A description of the established quality control organization, its functions and responsibilities, and

(4) If the application is for the manufacture of an aircraft, a description of the flight test procedure established by the manufacturer for the testing of production aircraft and a copy of the flight test check list to be used.

§ 2.21 *Requirements for issuance.* (a) The applicant shall hold a currently effective type certificate for the product to be manufactured, or shall hold a current right to the benefits of such certificate under a licensing arrangement.

(b) Upon receipt of the application with supporting information, and after an inspection of the applicant's organization and production facilities, the Administrator shall issue a production certificate if he finds that the applicant is adequately prepared to manufacture the product and to control its quality to the extent that each article will conform with the design provisions of the pertinent type certificate.

§ 2.22 *Production limitation record.* The benefits of a production certificate shall be available only with respect to the type certificate or certificates set forth in the currently effective production limitation record, prescribed and issued by the Administrator, which shall constitute a part of the production certificate.

§ 2.23 *Duration.* A production certificate shall remain in effect until such time as it is canceled, suspended, or revoked, a termination date is fixed by the Board, or the location of the manufacturing facilities is changed.

§ 2.24 *Changes.* The holder of a production certificate shall immediately notify the Administrator in writing of changes in the basic organization, methods, procedures, facilities, or location of the facilities which may affect the conformity of quality control of the product manufactured.

§ 2.25 *Transferability.* A production certificate is not transferable.

§ 2.26 *Amendments.* (a) The holder of a production certificate desiring the addition of another type certificate to the production certificate shall submit an application on a form provided by the Administrator for that purpose.

(b) The application shall be accompanied by a report describing clearly all additional facilities, methods, or processes required by the particular design of the product to be manufactured under the type certificate to be added.

(c) When, on the basis of the procedure specified in § 2.21, the Administrator finds the facilities, methods, and processes adequate he shall include the additional type certificate in the production limitation record.

TYPE AND PRODUCTION CERTIFICATE RULES

§ 2.30 *Display.* Type certificates shall be made available for examination by representatives of the Administrator or the Board. Production certificates shall be prominently displayed in the main office of the factory.

§ 2.31 *Cancellation.* Type and production certificates may be canceled upon the written request of the holder thereof.

§ 2.32 *Surrender.* Upon the cancellation, suspension, revocation, or termination of a type or production certificate, the holder thereof shall, upon request, surrender such certificate to an authorized representative of the Administrator.

§ 2.33 *Inspection.* (a) A product manufactured under a type certificate only shall, and a product manufactured under both type and production certificates may, be required to undergo inspection by a representative of, or a person designated by the Administrator, to determine whether individual products conform with the provisions of the pertinent type certificate.

(b) A representative of the Administrator shall be permitted to make such inspections as may be necessary to determine compliance with the requirements of this part.

§ 2.34 *Statement of conformity.* The holder of a type certificate or of a current right to the benefits of a type certificate under a licensing arrangement, upon the initial transfer by him of the ownership of any aircraft manufactured under such type certificate, shall furnish to a duly authorized representative of the Administrator a statement of conformity for such aircraft on a form prescribed by the Administrator, except that a statement of conformity shall not be required if the aircraft is manufactured for United States registry under the terms of a production certificate.

[Amdt. 02-0, 11 F. R. 7032, as amended by Amdt. 02-1, 12 F. R. 949]

§ 2.35 *Production reports.* On the 1st day of January and July of each year, and at such other times as the Administrator may require, every holder of a production certificate, a type certificate, or a current right to the benefits of a type certificate under a licensing arrangement, shall transmit to the Administrator a detailed production report on a form prescribed and furnished by the Administrator. Such reports shall be transmitted whether or not any product has been manufactured during the period covered by the report.

§ 2.36 *Identification.* Each article manufactured under the terms of a type or production certificate shall display permanently such data as may be required to show its identity. Such data shall include at least the following items where applicable:

(a) Manufacturer's name.
(b) Type certificate number.
(c) Production certificate number.
(d) Model designation.
(e) Manufacturer's serial number when article is serially numbered, or the date of manufacture, except where both are specifically required.
(f) Capacity or rating.

PART 3—AIRPLANE AIRWORTHINESS; NORMAL, UTILITY, ACROBATIC, AND RESTRICTED-PURPOSE CATEGORIES

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MISCELLANEOUS

AUTHORITY: §§ 3.1 to 3.792 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply sec. 601, 52 Stat. 1007; 49 U. S. C. 551.

SOURCE: §§ 3.1 to 3.792 contained in Amendment 03-0, Civil Air Regulations, 11 F. R. 13368, except as noted following sections affected. Redesignated at 13 F. R. 5486.

SUBPART A—AIRWORTHINESS REQUIREMENTS

GENERAL

§ 3.1 *Scope.* An airplane which has no features or characteristics rendering it unsafe for the category for which it is to be certificated is eligible for type and airworthiness certification, if it complies with all applicable provisions of this part, or, in the event it does not so comply, if it is shown to meet the same level of safety as that provided for in this part.

§ 3.2 *Date of effectiveness.* (a) Airplanes certificated as a type on or after November 13, 1945, shall comply either with (1) the entire provisions of Part 4a of this chapter in effect immediately prior to November 9, 1945, or (2) the entire provisions prescribed in this part, except that airplanes certificated under (1) may incorporate provisions of (2) when the Administrator finds the standard of safety to be equivalent to the particular and all related items of the latter.

(b) Airplanes certificated as a type on or after January 1, 1947, shall comply with the provisions contained in this part. If the prototype is not flown prior to January 1, 1947, and satisfactory evidence is presented indicating that the design work of the type was well advanced prior to November 13, 1945, and the delay of completion of the airplane was due to causes beyond the manufacturer's control, the Administrator may certificate the airplane as a type under the provisions of Part 4a of this chapter which were in effect prior to November 9, 1945.

(c) Unless otherwise specified, compliance with an amendment to this part shall be mandatory only for airplanes for which application for a type certificate has been received subsequent to the effective date of such amendment.

AIRPLANE CATEGORIES

§ 3.6 *Airplane categories.* (a) In this part airplanes are divided upon the basis of their intended operation into the following categories for the purpose of certification.

(1) *Normal—Suffix "N".* Airplanes in this category are intended for nonacrobatic, nonscheduled passenger, and nonscheduled cargo operation.

(2) *Utility—Suffix "U".* Airplanes in this category are intended for normal operations and limited acrobatic maneuvers. These airplanes are not suited for use in snap or inverted maneuvers.

NOTE: The following interpretation of paragraph (a) (2) was issued May 15, 1947, 12 F. R. 3434:

The phrase "limited acrobatic maneuvers" as used in § 3.6 is interpreted to include steep turns, spins, stalls (except whip stalls), lazy eights, and chandelles.

(3) *Acrobatic—Suffix "A".* Airplanes in this category will have no specific restrictions as to type of maneuver permitted unless the necessity therefor is disclosed by the required flight tests.

(4) *Restricted purpose—Suffix "R".* Airplanes in this category are intended to be operated for restricted purposes not logically encompassed by the foregoing categories. The requirements of this category shall consist of all of the provisions for any one of the foregoing categories which are not rendered inapplicable by the nature of the special purpose involved, plus suitable operating restrictions which the Administrator finds will provide a level of safety equivalent to that contemplated for the foregoing categories.

(b) An airplane may be certificated under the requirements of a particular category, or in more than one category, provided that all of the requirements of such categories are met. Sections of this part which apply to only one or more, but not all, categories are identified in this part by the appropriate suffixes, as indicated above, added to the section number. All sections not identified by a suffix are applicable to all categories except as otherwise specified.

NOTE: For rules governing the eligibility of airplanes certificated under this part for use in air carrier operations see Parts 40, 41, 42, and 61 of this chapter.

AIRWORTHINESS CERTIFICATES

§ 3.11 *Classification.* (a) Airworthiness certificates are classified as follows:

(1) *NC (standard) certificates.* In order to become eligible for an NC (standard) certificate, an airplane must be shown to comply with the requirements contained in this part for at least one category, but not the restricted-purpose category.

(2) *NR (restricted) certificates.* In order to become eligible for an NR (restricted) certificate, an airplane must be shown to comply with the requirements of the restricted purpose category.

(3) *NX (experimental) certificates.* An airplane will become eligible for an NX (experimental) certificate when the applicant presents satisfactory evidence that the airplane is to be flown for experimental purposes and the Administrator finds it may, with appropriate restrictions, be operated for that purpose in a manner which does not endanger the general public. Airplanes used in racing and exhibition flying may be issued NX (experimental) certificates under the terms of this section. The applicant shall submit sufficient data, such as photographs, to identify the airplane satisfactorily and, upon inspection of the airplane, any pertinent information found necessary by the Administrator to safeguard the general public.

(b) An airplane manufactured in accordance with a type certificate (see §§ 3.15–3.19) and conforming with the type design will become eligible for an airworthiness certificate when, upon inspection of the airplane, the Administrator determines it so to conform and that the airplane is in a condition for safe operation. For each newly manufactured airplane this determination shall include a flight check by the applicant.

[Amdt. 03-0, 11 F. R. 133.68, as amended by Amdt. 03-4, 13 F. R. 2965]

TYPE CERTIFICATES

§ 3.15 *Requirements for issuance.* A type certificate will be issued when the following requirements of §§ 3.16 to 3.19 are met.

§ 3.16 *Data required for NC and NR certification.* The applicant for a type certificate shall submit to the Administrator such descriptive data, test reports, and computations as are necessary to demonstrate that the airplane complies with the airworthiness requirements. The descriptive data shall be known as the type design and shall consist of drawings and specifications disclosing the configuration of the airplane and all design features covered in the airworthiness requirements as well as sufficient information on dimensions, materials, and processes to define the strength of the structure. The type design shall describe the airplane in sufficient detail to permit the airworthiness of subsequent airplanes of the same type to be determined by comparison with the type design.

[Amdt. 03-0, 11 F. R. 13368, as amended by Amdt. 03-4, 13 F. R. 2965]

§ 3.17 *Inspection and tests for NC and NR certification.* The authorized representatives of the Administrator shall have access to the airplane and may witness or conduct such inspections and tests as are necessary to determine compliance with the airworthiness requirements.

[Amdt. 03-0, 11 F. R. 13368, as amended by Amdt. 03-4, 13 F. R. 2965]

§ 3.18 *Inspection.* Inspections and tests shall include all those found necessary by the Administrator to insure that the airplane conforms with the following:

(a) All materials and products are in accordance with the specification given in the type design.

(b) All parts of the airplane are constructed in accordance with the drawings contained in the type design.

(c) All manufacturing processes, construction, and assembly are such that the design strength and safety contemplated by the type design will be realized in service.

§ 3.19 *Flight tests.* (Applicable to all airplanes certificated as a type on or after May 15, 1947.) After proof of compliance with the structural requirements contained in this part, and upon completion of all necessary inspection and testing on the ground, and proof of the conformity of the airplane with the type design, and upon receipt from the applicant of a report of flight tests conducted by him, there shall be conducted such official flight tests as the Administrator finds necessary to determine compliance with §§ 3.61 through 3.780. After the conclusion of these flight tests such additional flight tests shall be conducted as the Administrator finds necessary to ascertain whether there is reasonable assurance that the airplane, its components, and equipment are reliable and function properly. The extent of such additional flight tests shall depend upon the complexity of the airplane, the number and nature of new design features, and the record of previous tests and experience for the particular airplane model, its components, and equipment. If practicable, the flight tests performed for the purpose of ascertaining the reliability and proper functioning shall be conducted on the same airplane which was used in flight tests to show compliance with §§ 3.61 through 3.780.

[Amdt. 03-1, 12 F. R. 1028, as amended by Amdt. 03-2, 12 F. R. 2086]

CHANGES

§ 3.23 *Changes.* Changes shall be substantiated to demonstrate compliance of the airplane with the appropriate airworthiness requirements in effect when the particular airplane was certificated as a type, unless the holder of the type certificate chooses to show compliance with the currently effective requirements subject to the approval of the Administrator, or unless the Administrator finds it necessary to require compliance with current airworthiness requirements.

§ 3.23-11 *Changes of engines (CAA policies which apply to § 3.23).* There are currently available newly designed engines of approximately the same size and weight as previously designed engines, but with considerable variations in power. It is possible to interchange these engines with little or no installation changes, and although minor changes in engine weight may be involved, it will still be practical to operate the aircraft at the originally approved gross weight. Under § 3.185, the maneuvering load factor is not dependent upon engine power, and under § 3.184, the design air speeds can be independent of engine power. Therefore, a change which involves or permits a practical power increase by exchange of engines shall be approved by the Administrator: *Provided,* That such exchange of engines is not accompanied by increase in the gross weight of the aircraft or an increase in placard speeds. Under these conditions it will not be necessary to restrict the maximum continuous horsepower by a placard because of the airplane speed limitations, since the latter are indicated on the speed placards. Aircraft alterations involving weight or speed changes beyond those set forth above will be approved by the Administrator only if the applicant shows compliance with all of the applicable sections of Part 4a of this chapter, or all of the applicable sections of Part 3, or relies on the provisions of § 3.2 by complying with certain particular and related items of the requirements under this part, and certain of the requirements under Part 4a of this chapter, i. e., the level of safety for certain particular and related items is equivalent to the requirements under this part and the level of safety for the remaining items is equivalent to the requirements under Part 4a of this chapter. Under § 3.23 it will be necessary to require such investigations of local structure, weight and balance, power-plant installations, and flight tests as are normally involved in a change of engine type.

[12 F. R. 3434. Correction noted at 14 F. R. 36]

§ 3.24 *Minor changes.* Minor changes to certificated airplanes which obviously do not impair the condition of the airplane for safe operation shall be approved by the authorized representatives of the Administrator prior to the submittal to the Administrator of any required revised drawings.

§ 3.25 *Major changes.* A major change is any change not covered by minor changes as defined in § 3.24.

§ 3.26 *Service experience changes.* When experience shows that any particular part or characteristic of an airplane is unsafe, the holder of the type certificate for such airplane shall submit for approval of the Administrator the design changes which are necessary to correct the unsafe condition. After the unsafe condition becomes known the Administrator shall withhold the issuance of airworthiness certificates for additional airplanes of the type involved until he has approved the design changes and until the additional airplanes are modified to include such changes. Upon approval by the Administrator the design changes shall be considered as a part of the type design, and descriptive data covering these changes shall be made available by the holder of the type certificate to all owners of airplanes previously certificated under such type certificate.

§ 3.27 *Application to earlier airworthiness requirements.* In the case of airplanes approved as a type under the terms of earlier airworthiness requirements, the Administrator may require that an airplane submitted for an original airworthiness certificate comply with such portions of the currently effective airworthiness requirements as may be necessary for safety.

APPROVAL OF MATERIALS, PARTS, PROCESSES, AND APPLIANCES

§ 3.31 *Specifications.* (a) Materials, parts, processes, and appliances shall be approved upon a basis and in a manner found necessary by the Administrator to implement the pertinent provisions of this subchapter. The Administrator may adopt and publish such specifications as he finds necessary to administer this section, and shall incorporate therein such portions of the aviation industry, Federal, and military specifications respecting such materials, parts, processes, and appliances as he finds appropriate.

(b) Any material, part, process, or appliance shall be deemed to have met the requirements for approval when it meets the pertinent specifications adopted by the Administrator, and the manufacturer so certifies in a manner prescribed by the Administrator.

[Amdt. 03-3, 12 F. R. 7898]

DEFINITIONS

§ 3.41 *Standard atmosphere.* The standard atmosphere shall be based upon the following assumptions:

(a) The air is a dry perfect gas.

(b) The temperature at sea level is 59° F.

(c) The pressure at sea level is 29.92 inches Hg.

(d) The temperature gradient from sea level to the altitude at which the temperature becomes −67° F. is −0.003566° F. per foot and zero thereabove.

(e) The desnity ρ_0 at sea level under the above conditions is 0.002378 lbs. sec.^{2}/ft.^{4}.

§ 3.42 *Hot-day condition.* See § 3.583.

§ 3.43 *Airplane configuration.* This term refers to the position of the various elements affecting the aerodynamic characteristics of the airplane, such as landing gear and flaps.

§ 3.44 *Weights.*

	Reference sections
Empty weight: The actual weight used as a basis for determining operating weights	3.73
Maximum weight: The maximum weight at which the airplane may operate in accordance with the airworthiness requirements	3.74
Minimum weight: The minimum weight at which compliance with the airworthiness requirements is demonstrated	3.75
Maximum design weight: The maximum weight used for the structural design of the airplane	3.181
Minimum design weight: The minimum weight condition investigated in the structural flight load conditions, not greater than the minimum weight specified in § 3.75	3.181
Design landing weight: The weight used in the structural investigation of the airplane for normal landing conditions. Under the provisions of § 3.242, this weight may be equal to or less than the maximum design weight	3.242

Unit weights for design purposes:

Gasoline	6 pounds per United States gallon.
Lubricating oil	7.5 pounds per United States gallon.
Crew and passengers	170 pounds per person.

§ 3.45 *Power.*

One horsepower: 33,000 foot-pounds per minute.

Take-off power: The take-off rating of the engine established in accordance with Part 13, Aircraft Engine Airworthiness.

Maximum continuous power: The maximum continuous rating of the engine established in accordance with Part 13, Aircraft Engine Airworthiness.

§ 3.46 *Speeds.*

V_t True air speed of the airplane relative to the undisturbed air.

In the following symbols having subscripts, V denotes:

(a) "Equivalent" air speed for structural design purposes equal to $V_t\sqrt{\rho/\rho_0}$.

(b) "True indicated" or "calibrated" air speed for performance and operating purposes equal to indicator reading corrected for position and instrument errors.

	Reference sections
V_{s_0} stalling speed, in the land configuration	3.82
V_{s_1} stalling speed in the configurations specified for particular conditions	3.82
V_{sf} computed stalling speed at design landing weight with flaps fully deflected	3.190
V_x speed for best angle of climb.	
V_y speed for best rate of climb.	
V_{mc} minimum control speed	3.111
V_f design speed for flight load conditions with flaps in landing position	3.190
V_{fe} flaps-extended speed	3.742
V_p design maneuvering speed	3.184
V_c design cruising speed	3.184
V_d design dive speed	3.184
V_{ne} never-exceed speed	3.739
V_{no} maximum structural cruising speed	3.740
V_h maximum speed in level flight at maximum continuous power.	

§ 3.47 *Structural terms.*

Structure: Those portions of the airplane the failure of which would seriously endanger the safety of the airplane.

Design wing area, S: The area enclosed by the wing outline (including ailerons, and flaps in the retracted position, but ignoring fillets and fairings) on a surface containing the wing chords. The outline is assumed to extend through the nacelles and fuselage to the centerline of symmetry.

Aerodynamic coefficients: C_L, C_N, C_M, etc., used in this part, are nondimensional coefficients for the forces and moments acting on an airfoil, and correspond to those adopted by the United States National Advisory Committee for Aeronautics.

C_L = airfoil lift coefficient.

C_N = airfoil normal force coefficient (normal to wing chord line).

C_{NA} = airplane normal force coefficient (based on lift of complete airplane and design wing area).

C_M = pitching moment coefficient.

Loads	Reference sections
Limit load: The maximum load anticipated in service	8.171
Ultimate load: The maximum load which a part of structure must be capable of supporting	3.173
Factor of safety: The factor by which the limit load must be multiplied to establish the ultimate load	8.172

Load factor or acceleration factor, n: The ratio of the force acting on a mass to the weight of the mass. When the force in question represents the net external load acting on the airplane in a given direction, n represents the acceleration in that direction in terms of the gravitational constant.

Limit load factor: The load factor corresponding to limit load.

Ultimate load factor: The load factor corresponding to ultimate load.

§ 3.48 *Susceptibility of materials to fire.* Where necessary for the purpose of determining compliance with any of the definitions in this section, the Administrator shall prescribe the heat conditions and testing procedures which any specific material or individual part must meet.

(a) *Fireproof.* "Fireproof" material means a material which will withstand heat equally well or better than steel in dimensions appropriate for the purpose for which it is to be used. When applied to material and parts used to confine fires in designated fire zones "fireproof" means that the material or part will perform this function under the most severe conditions of fire and duration likely to occur in such zones.

(b) *Fire-resistant.* When applied to sheet or structural members, "fire-resistant" material shall mean a material which will withstand heat equally well or better than aluminum alloy in dimensions appropriate for the purpose for which it is to be used. When applied to fluid-carrying lines, this term refers to a line and fitting assembly which will perform its intended protective functions under the heat and other conditions likely to occur at the particular location.

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

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

(e) *Inflammable.* "Inflammable" fluids or gases means those which will ignite readily or explode.

§ 3.48-1 *Fire-resistant aircraft material (CAA rules which apply to § 3.48).* See § 4b.448-3 of this chapter.

[13 F. R. 7723]

Subpart B—Flight Requirements

General

§ 3.61 *Policy re proof of compliance.* Compliance with the requirements specified in this subpart governing functional characteristics shall be demonstrated by suitable flight or other tests conducted upon an airplane of the type, or by calculations based upon the test data referred to above, provided that the results so obtained are substantially equal in accuracy to the results of direct testing. Compliance with each requirement must be provided at the critical combination of airplane weight and center of gravity position within the range of either for which certification is desired. Such compliance must be demonstrated by systematic investigation of all probable weight and center of gravity combinations or must be reasonably inferable from such as are investigated.

§ 3.62 *Flight test pilot.* The applicant shall provide a person holding an appropriate pilot certificate to make the flight tests, but a designated representative of the Administrator may pilot the airplane insofar as that may be necessary for the determination of compliance with the airworthiness requirements.

§ 3.63 *Noncompliance with test requirements.* Official type tests will be discontinued until corrective measures have been taken by the applicant when either:

(a) The applicant's test pilot is unable or unwilling to conduct any of the required flight tests; or

(b) Items of noncompliance with requirements are found which may render additional test data meaningless or are of such nature as to make further testing unduly hazardous.

§ 3.64 *Emergency egress.* Adequate provisions shall be made for emergency egress and use of parachutes by members of the crew during the flight tests.

§ 3.65 *Report.* The applicant shall submit to the representative of the Administrator a report covering all computations and tests required in connection with calibration of instruments used for test purposes and correction of test results to standard atmospheric conditions. The representative of the Administrator will conduct any flight tests which he finds to be necessary in order to check the calibration and correction report.

Weight Range and Center of Gravity

§ 3.71 *Weight and balance.* (a) There shall be established, as a part of the type inspection, ranges of weight and center of gravity within which the airplane may be safely operated.

(b) When low fuel adversely affects balance or stability, the airplane shall be so tested as to simulate the condition existing when the amount of usable fuel on board does not exceed 1 gallon for every 12 maximum continuous horsepower of the engine or engines installed.

§ 3.72 *Use of ballast.* Removable ballast may be used to enable airplanes to comply with the flight requirements in accordance with the following provisions:

(a) The place or places for carrying ballast shall be properly designed, installed, and plainly marked as specified in § 3.766.

(b) The Airplane Flight Manual shall include instructions regarding the proper disposition of the removable ballast under all loading conditions for which such ballast is necessary, as specified in § 3.755-3.770.

§ 3.73 *Empty weight.* The empty weight and corresponding center of gravity location shall include all fixed ballast, the unusable fuel supply (see § 3.437), undrainable oil, full engine coolant, and hydraulic fluid. The weight and location of items of equipment installed when the airplane is weighed shall be noted in the Airplane Flight Manual.

§ 3.74 *Maximum weight.* The maximum weight shall not exceed any of the following:

(a) The weight selected by the applicant.

(b) The design weight for which the structure has been proven.

(c) The maximum weight at which compliance with all of the requirements specified is demonstrated, and shall not be less than the sum of the weights of the following:

(1) The empty weight as defined by § 3.73.

(2) One gallon of usable fuel (see § 3.437) for every seven maximum continuous horsepower for which the airplane is certificated.

(3) The full oil capacity.

(4) 170 pounds in all seats (normal category) or 190 pounds in all seats (utility and acrobatic category) unless placarded otherwise.

§ 3.75 *Minimum weight.* The minimum weight shall not exceed the sum of the weights of the following:

(a) The empty weight as defined by § 3.73.

(b) The minimum crew necessary to operate the airplane (170 pounds for each crew member).

(c) One gallon of usable fuel (see § 3.437) for every 12 maximum continuous horsepower for which the airplane is certificated.

(d) Either 1 gallon of oil for each 25 gallons of fuel specified in (c) or 1 gallon of oil for each 75 maximum continuous horsepower for which the airplane is certificated, whichever is greater.

§ 3.76 *Center of gravity position.* If the center of gravity position under any possible loading condition between the maximum weight as specified in § 3.74 and the minimum weight as specified in § 3.75 lies beyond (a) the extremes selected by the applicant, or (b) the extremes for which the structure has been proven, or (c) the extremes for which compliance with all functional requirements were demonstrated, loading instructions shall be provided in the Airplane Flight Manual as specified in § 3.777–3.780.

Performance Requirements

General

§ 3.81 *Performance.* The following items of performance shall be determined and the airplane shall comply with the corresponding requirements in standard atmosphere and still air.

§ 3.82 *Definition of stalling speeds.* (a) V_{s_0} denotes the true indicated stalling speed, if obtainable, or the minimum steady flight speed at which the airplane is controllable, in miles per hour, with:

(1) Engines idling, throttles closed (or not more than sufficient power for zero thrust),

(2) Propellers in position normally used for take-off,

(3) Landing gear extended,

(4) Wing flaps in the landing position,

(5) Cowl flaps closed,

(6) Center of gravity in the most unfavorable position within the allowable landing range,

(7) The weight of the airplane equal to the weight in connection with which V_{s_0} is being used as a factor to determine a required performance.

(b) V_{s_1} denotes the true indicated stalling speed, if obtainable, otherwise the calculated value in miles per hour, with:

(1) Engines idling, throttles closed (or not more than sufficient power for zero thrust),

(2) Propellers in position normally used for take-off, the airplane in all other respects (flaps, landing gear, etc.) in the particular condition existing in the particular test in connection with which V_{s_1} is being used,

(3) The weight of the airplane equal to the weight in connection with which V_{s_1} is being used as a factor to determine a required performance.

(c) These speeds shall be determined by flight tests using the procedure outlined in § 3.120.

§ 3.82–1 *"Zero thrust" (CAA interpretations which apply to § 3.82).* As used in § 3.82 (a) (1) and (b) (1) the term "zero thrust" contained in the phrase "engines idling, throttles closed (or not more than sufficient power for zero thrust)" is interpreted to permit "zero thrust at a speed not greater than 110 percent of the stalling speed."

[12 F. R. 3434. Correction noted at 14 F. R. 36]

§ 3.83 *Stalling speed.* V_{s_0} at maximum weight shall not exceed 70 miles per hour for (1) single-engine airplanes and (2) multiengine airplanes which do not have the rate of climb with critical engine inoperative specified in § 3.85 (b).

§ 3.83–1 *Stalling speed of "not to exceed 70 miles per hour (CAA interpretations which apply to § 3.83).* In connection with any application to have an aircraft certificated for airworthiness under a combination of the requirements of this part and Part 4a of this chapter as authorized by the provisions of § 3.2, the stalling speed of "not to exceed 70 miles per hour" established in § 3.83 is interpreted to apply only to airplanes which comply with all of the following sections of the Civil Air Regulations which are construed by the Administrator to cover "related items": § 3.84 (Take-off); § 3.86 (Landing); § 3.120 (Stalling); § 3.121 (Climbing stalls); § 3.122 (Turning flight stalls); § 3.123 (One-engine-inoperative stalls); § 3.143 (Ground and water characteristics).

[12 F. R. 3434. Correction noted at 14 F. R. 36]

Take-off

§ 3.84 *Take-off.* (a) The distance required to take off and climb over a 50-foot obstacle shall be determined under the following conditions:

(1) Most unfavorable combination of weight and center of gravity location,

(2) Engines operating within the approved limitations,

(3) Cowl flaps in the position normally used for take-off.

(b) Upon obtaining a height of 50 feet above the level take-off surface, the airplane shall have attained a speed of not less than 1.3 V_{s_1} unless a lower speed of not less than V_x plus 5 can be shown to be safe under all conditions, including turbulence and complete engine failure.

(c) The distance so obtained, the type of surface from which made, and the pertinent information with respect to the cowl flap position, the use of flight-path control devices and landing gear retraction system shall be entered in the Airplane Flight Manual. The take-off shall be made in such a manner that its reproduction shall not require an exceptional degree of skill on the part of the pilot or exceptionally favorable conditions.

§ 3.84–11 *Take-off performance (CAA policies which apply to § 3.84).* To meet the requirements of § 3.84 pertaining to certification of take-off performance and to provide the Airplane Flight Manual performance data required in § 3.780 (a) (3) and (4), it is necessary that a suitable method be used for the purpose of determining these items during official type tests. The Administrator will accept the following procedure for this purpose:

The ground and climb distances may be determined separately and the corrected data placed together (as is now done in the transport category). Thus, for the simplest procedure, the airplane shall be accelerated on (or near) the ground with gear extended to a speed not less than 1.3 V_{s_1}, and a climb segment to the 50-foot height point with gear extended shall be determined by saw-tooth climb data. If it is desired to assume retraction of the landing gear at an earlier point, such point shall be assured to occur not earlier than that which would be used in normal take-offs. The acceleration to 1.3 V_{s_1} shall then be measured as above, with gear retraction being initiated at the selected speed. If gear retraction is completed before reaching 1.3 V_{s_1}, only one climb segment, with gear retracted, need be determined. If retraction is not completed during acceleration to 1.3 V_{s_1}, two climb segments shall be determined; one with gear extended for the time period necessary to complete retraction; the second with gear retracted. The acceleration segment shall be determined photographically, and a minimum of three trials shall be made up to speeds equal to or greater than 1.3 V_{s_1}.

NOTE: It is permissible for other methods to be used in accomplishing these tests, providing that any method used is one which the average pilot may be reasonably expected to duplicate without use of unusual skill or experience, and one which produces equivalent accuracy. The operating procedure which must be followed to achieve the measured performance shall in all cases be described in the Airplane Flight Manual. (CAA camera equipment may be obtained on a loan basis.)

[12 F. R. 3434. Correction noted at 14 F. R. 36]

Climb

§ 3.85 *Climb*—(a) *Normal climb condition.* The steady rate of climb at sea level shall be at least 300 feet per minute, and the steady angle of climb at least 1:12 for landplanes or 1:15 for seaplanes with:

(1) Not more than maximum continuous power on all engines,

(2) Landing gear fully retracted,

(3) Wing flaps in take-off position,

(4) Cowl flaps in the position used in cooling tests specified in §§ 3.581–3.596.

(b) *Climb with inoperative engine.* All multiengine airplanes having a stalling speed V_{s_0} greater than 70 miles per hour or a maximum weight greater than 6,000 pounds shall have a steady rate of climb of at least 0.02 $V_{s_0}^2$ in feet per minute at an altitude of 5,000 feet with the critical engine inoperative and:

(1) The remaining engines operating at not more than maximum continuous power,

(2) The inoperative propeller in the minimum drag position,

(3) Landing gear retracted,

(4) Wing flaps in the most favorable position,

(5) Cowl flaps in the position used in cooling tests specified in §§ 3.581–3.596.

(c) *Balked landing conditions.* The steady angle of climb at sea level shall be at least 1:30 with:

(1) Take-off power on all engines,
(2) Landing gear extended,
(3) Wing flaps in landing position.

If rapid retraction is possible with safety without loss of altitude and without requiring sudden changes of angle of attack or exceptional skill on the part of the pilot, wing flaps may be retracted.

§ 3.85–1 *Rate of climb (CAA policies which apply to § 3.85).* To meet the requirements of § 3.85 it is necessary that a suitable method be employed for the purpose of determining the rates of climb. The Administrator will accept the following procedure for this purpose:

This method of obtaining rates of climb is through the derivation of a polar curve obtained from a series of saw-tooth climbs at various speeds. When saw-tooth climbs are employed, a minimum of five different speeds is required. However, demonstration climbs to prove the article meets the minimum climb requirement may be made at one given air speed. In such cases, the minimum number of climbs at one air speed shall be not less than three. This may not be interpreted to mean the best three of a number of climbs. In the event additional climbs are made the average of the total shall be the value to be accepted. It shall be permissible, however, to discard any climbs which are obviously in error due to such factors as turbulent air.

[12 F. R. 3434. Correction noted at 14 F. R. 36]

§ 3.85–2 *"Normal climb" and "cooling test procedure for single-engine airplanes" (CAA interpretations which apply to § 3.85).* In connection with any application to have an aircraft certified for airworthiness under a combination of the requirements of this part and Part 4a of this chapter as authorized by the provisions of § 3.2, the items of "normal climb" (§ 3.85 (a)) and "cooling test procedure for single-engine airplanes" (§ 3.586), shall be construed by the Administrator as "related items."

[12 F. R. 3435. Correction noted at 14 F. R. 36]

§ 3.85–3 *"Rapid retraction" (CAA interpretations which apply to § 3.85).* The Administrator will consider retraction of flaps in 2 seconds or less as compliance with the factor of "rapid retraction" as that phrase is used in § 3.85 (c).

[12 F. R. 3435. Correction noted at 14 F. R. 36]

§ 3.85–4 *Weight for items of performance and flight characteristics (CAA interpretations which apply to § 3.85).* For multiengine airplanes in which the design landing weight (§ 3.242) is less than the maximum weight (§ 3.74) for which certification is desired, the weight for items of performance and flight characteristics shall be construed by the Administrator as the maximum weight defined in § 3.74. Such items of performance and flight characteristics shall consist of balked landing (climb) conditions (§ 3.74), landing over 50-foot obstacles (§ 3.86), and all flight characteristics tests in the landing configuration. The design weight covered in § 3.242 is intended for use for structural design purposes only.

[12 F. R. 3435. Correction noted at 14 F. R. 36]

LANDING

§ 3.86 *Landing.* (a) The horizontal distance required to land and to come to a complete stop (to a speed of approximately 3 miles per hour for seaplanes or float planes) from a point at a height of 50 feet above the landing surface shall be determined as follows:

(1) Immediately prior to reaching the 50-foot altitude, a steady gliding approach shall have been maintained, with a true indicated air speed of at least 1.3 V_{s_0}.

(2) The landing shall be made in such a manner that there is no excessive vertical acceleration, no tendency to bounce, nose over, ground loop, porpoise, or water loop, and in such a manner that its reproduction shall not require any exceptional degree of skill on the part of the pilot or exceptionally favorable conditions.

(b) The distance so obtained, the type of landing surface on which made and the pertinent information with respect to cowl flap position, and the use of flight path control devices shall be entered in the Airplane Flight Manual.

§ 3.86–1 *Landing distances (CAA policies which apply to § 3.86).* The Administrator will not approve the use of landing distances obtainable with reverse-thrust propellers in establishing landing field lengths until such time as sufficient experience with their use is available for proper consideration of all related factors involved in the establishment of adequate airport lengths for routine landings.

[12 F. R. 3437. Correction noted at 14 F. R. 36]

FLIGHT CHARACTERISTICS

§ 3.105 *Requirements.* The airplane shall meet the requirements set forth in §§ 3.106 to 3.124 at all normally expected operating altitudes under all critical loading conditions within the range of center of gravity and, except as otherwise specified, at the maximum weight for which certification is sought.

CONTROLLABILITY

§ 3.106 *General.* The airplane shall be satisfactorily controllable and maneuverable during take-off, climb, level flight, drive, and landing with or without power. It shall be possible to make a smooth transition from one flight condition to another, including turns and slips, without requiring an exceptional degree of skill, alertness, or strength on the part of the pilot, and without danger of exceeding the limit load factor under all conditions of operation probable for the type, including for multiengine airplanes those conditions normally encountered in the event of sudden failure of any engine. Compliance with "strength of pilots" limits need not be demonstrated by quantitative tests unless the Administrator finds the condition to be marginal. In the latter case they shall not exceed maximum values found by the Administrator to be appropriate for the type but in no case shall they exceed the following limits:

	Pitch	Roll	Yaw
(a) For temporary application:			
Stick	60	30	150
Wheel[1]	75	60	150
(b) For prolonged application	10	5	20

[1] Applied to rim.

§ 3.107–U *Approved acrobatic maneuvers.* It shall be demonstrated that the approved acrobatic maneuvers can be performed safely. Safe entry speeds shall be determined for these maneuvers.

§ 3.108–A *Acrobatic maneuvers.* It shall be demonstrated that acrobatic maneuvers can be performed readily and safely. Safe entry speeds shall be determined for these maneuvers.

§ 3.109 *Longitudinal control.* The airplane shall be demonstrated to comply with the following requirements:

(a) It shall be possible at all speeds below V_x to pitch the nose downward so that the rate of increase in air speed is satisfactory for prompt acceleration to V_x with:

(1) Maximum continuous power on all engines, the airplane trimmed at V_x.

(2) Power off, the airplane trimmed at 1.4 V_{s_1}.

(3) (i) Wing flaps and landing gear extended and

(ii) Wing flaps and landing gear retracted.

(b) During each of the controllability demonstrations outlined below it shall not require a change in the trim control or the exertion of more control force than can be readily applied with one hand for a short period. Each maneuver shall be performed with the landing gear extended.

(1) With power off, flaps retracted, and the airplane trimmed at 1.4 V_{s_1}, the flaps shall be extended as rapidly as possible while maintaining the air speed at approximately 40 percent above the instantaneous value of the stalling speed.

(2) Same as subparagraph (1) of this paragraph, except the flaps shall be initially extended and the airplane trimmed at 1.4 V_{s_1}, then the flaps shall be retracted as rapidly as possible.

(3) Same as subparagraph (2) of this paragraph, except maximum continuous power shall be used.

(4) With power off, the flaps retracted, and the airplane trimmed at 1.4 V_{s_1}, take-off power shall be applied quickly while the same air speed is maintained.

(5) Same as subparagraph (4) of this paragraph, except with the flaps extended.

(6) With power off, flaps extended, and the airplane trimmed at 1.4 V_{s_1}, air speeds within the range of 1.1 V_{s_1} to 1.7 V_{s_1} or V_f, whichever is the lesser, shall be obtained and maintained.

(c) It shall be possible without the use of exceptional piloting skill to maintain essentially level flight when flap retraction from any position is initiated during steady horizontal flight at 1.1 V_{s_1} with simultaneous application of not more than maximum continuous power.

§ 3.110 *Lateral and directional control.* (a) It shall be possible with multiengine airplanes to execute 15-degree banked turns both with and against the inoperative engine from steady climb at 1.4 V_{s_1} or V_y for the condition with:

(1) Maximum continuous power on the operating engines,
(2) Rearmost center of gravity,
(3) (i) Landing gear retracted and
(ii) Landing gear extended.
(4) Wing flaps in most favorable climb position,
(5) Maximum weight,
(6) The inoperative propeller in its minimum drag condition.

(b) It shall be possible with multiengine airplanes, while holding the wings level laterally within 5 degrees, to execute sudden changes in heading in both directions without dangerous characteristics being encountered. This shall be demonstrated at 1.4 V_{s_1} or V_y up to heading changes of 15 degrees, except that the heading change at which the rudder force corresponds to that specified in § 3.106 need not be exceeded, with:

(1) The critical engine inoperative,
(2) Maximum continuous power on the operating engine(s),
(3) (i) Landing gear retracted and
(ii) Landing gear extended,
(4) Wing flaps in the most favorable climb position,
(5) The inoperative propeller in its minimum drag condition,
(6) The airplane center of gravity at its rearmost position.

§ 3.111 *Minimum control speed* (V_{mc}). (a) A minimum speed shall be determined under the conditions specified below, such that when any one engine is suddenly made inoperative at that speed, it shall be possible to recover control of the airplane, with the one 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 a bank not in excess of 5 degrees. Such speed shall not exceed 1.3 V_{s_1}, with:

(1) Take-off or maximum available power on all engines,
(2) Rearmost center of gravity,
(3) Flaps in take-off position,
(4) Landing gear retracted.

(b) In demonstrating this minimum speed, the rudder force required to maintain it shall not exceed forces specified in § 3.106, nor shall it be necessary to throttle the remaining engines. During recovery 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.

TRIM

§ 3.112 *Requirements.* (a) The means used for trimming the airplane shall be such that, after being trimmed and without further pressure upon or movement of either the primary control or its corresponding trim control by the pilot or the automatic pilot, the airplane will maintain:

(1) Lateral and directional trim in level flight at a speed of 0.9 V_h or at V_c, if lower, with the landing gear and wing flaps retracted;

(2) Longitudinal trim under the following conditions:

(i) During a climb with maximum continuous power at a speed between V_x and 1.4 V_{s_1},

(*a*) With landing gear retracted and wing flaps retracted,

(*b*) With landing gear retracted and wing flaps in the take-off position.

(ii) During a glide with power off at a speed not in excess of 1.4 V_{s_1},

(*a*) With landing gear extended and wing flaps retracted,

(*b*) With landing gear extended and wing flaps extended under the forward center of gravity position approved with the maximum authorized weight,

(*c*) With landing gear extended and wing flaps extended under the most forward center of gravity position approved, regardless of weight.

(iii) During level flight at any speed from 0.9 V_h to V_x or 1.4 V_{s_1} with landing gear and wing flaps retracted.

(b) In addition to the above, multiengine airplanes shall maintain longitudinal and directional trim at a speed between V_y and 1.4 V_{s_1} during climbing flight with the critical of two or more engines inoperative, with:

(1) The other engine(s) operating at maximum continuous power,
(2) The landing gear retracted,
(3) Wing flaps retracted,
(4) Bank not in excess of 5 degrees.

§ 3.112-1 *Performance as alternate test (CAA policies which apply to § 3.112).* The following performance standards will be used for the purpose of administering § 3.112 (a) (2) (ii):

(a) In the case of new airplane designs which, due to their being equipped with high lift devices, cannot meet the required trim at 1.4 times stall speed with the landing gear and flaps extended, the Administrator, as authorized in § 3.1, will accept, as being of equivalent safety, performance with the flaps extended based on the following standards:

(1) The flap-down power-off stalling speed shall not exceed 90 percent of the flap-retracted power-off stalling speed.

(2) The minimum trim speed with power off, flaps and landing gear extended, under the forward center of gravity position approved with the maximum authorized weight, and under the most forward center of gravity position approved, regardless of weight, shall not exceed 1.5 times the stall speed for that configuration.

(3) The force required to maintain steady flight in this configuration at 1.4 V_{s_1}, shall not exceed 10 pounds.

(4) It shall be possible, trimmed in this configuration, to execute a normal power-off landing without exceeding a stick force of 40 pounds.

(5) It shall be possible, with the stick free, to reduce the rate of descent to zero and simultaneously bring the airplane to an attitude suitable for landing, using not more than maximum continuous power. During this demonstration the flaps-extended speed shall not be exceeded.

(b) When the standards set forth above are relied upon to determine compliance with this section of the Civil Air Regulations, the Administrator will accept as equivalent safety a demonstration of the following items at 1.5 times stall speed instead of 1.4 times stall speed:: Longitudinal control (§ 3.109 (a) and (b) (2), (5), and (6)). Specific conditions (§ 3.115 (a)).

[12 F. R. 3435. Correction noted at 14 F. R. 36]

STABILITY

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

§ 3.114 *Static longitudinal stability.* In the configurations outlined in § 3.115 and with the airplane trimmed as indicated, the characteristics of the elevator control forces and the friction within the control system shall be such that:

(a) A pull shall be required to obtain and maintain speeds below the specified trim speed and a push to obtain and maintain speeds above the specified trim speed. This shall be so at any speed which can be obtained without excessive control force, except that such speeds need not be greater than the appropriate maximum permissible speed or less than the minimum speed in steady unstalled flight.

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

§ 3.115 *Specific conditions.* In conditions set forth in this section, within the speeds specified, the stable slope of stick force versus speed curve shall be such that any substantial change in speed is clearly perceptible to the pilot through a resulting change in stick force.

(a) *Landing.* The stick force curve shall have a stable slope and the stick force shall not exceed 40 lbs. at any speed between 1.1 V_{s_1} and 1.8 V_{s_1} with:

(1) Wing flaps in the landing position,
(2) The landing gear extended,
(3) Maximum weight,
(4) Throttles closed on all engines,
(5) The airplane trimmed at 1.4 V_{s_1} with throttles closed.

(b) *Climb.* The stick force curve shall have a stable slope at all speeds between 1.2 V_{s_1} and 1.6 V_{s_1} with:

(1) Wing flaps retracted,
(2) Landing gear retracted,
(3) Maximum weight,
(4) 75 percent of maximum continuous power,
(5) The airplane trimmed at 1.4 V_{s_1}.

(c) *Cruising.* (1) Between 1.3 V_{s_1} and the maximum permissible speed, the stick force curve shall have a stable slope at all speeds obtainable with a stick force not in excess of 40 pounds with:

(i) Landing gear retracted,
(ii) Wing flaps retracted,
(iii) Maximum weight,
(iv) 75 percent of maximum continuous power,
(v) The airplane trimmed for level flight with 75 percent of the maximum continuous power.

(2) Same as subparagraph (1) of this paragraph, except that the landing gear shall be extended and the level flight trim speed need not be exceeded.

§ 3.116 *Instrumented stick force measurements.* Instrumented stick force measurements need not be made when changes in speed are clearly reflected by changes in stick forces and the maximum forces obtained in the above conditions are not excessive.

§ 3.117 *Dynamic longitudinal stability.* Any short period oscillation occurring between stalling speed and maximum permissible speed shall be heavily damped with the primary controls (1) free, and (2) in a fixed position.

§ 3.118 *Directional and lateral stability*—(a) *Three-control airplanes.* (1) The static directional stability, as shown by the tendency to recover from a skid with rudder free, shall be positive for all flap positions and symmetrical power conditions, and for all speeds from 1.2 V_{s_1} up to the maximum permissible speed.

(2) The static lateral stability as shown by the tendency to raise the low wing in a sideslip, for all flap positions and symmetrical power conditions, shall:

(i) Be positive at the maximum permissible speed.

(ii) Not be negative at a speed equal to 1.2 V_{s_1}.

(3) In straight steady sideslips (unaccelerated forward slips), the aileron and rudder control movements and forces shall increase steadily, but not necessarily in constant proportion, as the angle of sideslip is increased; the rate of increase of the movements and forces shall lie between satisfactory limits up to sideslip angles considered appropriate to the operation of the type. At greater angles, up to that at which the full rudder control is employed or a rudder pedal force of 150 pounds is obtained, the rudder pedal forces shall not reverse and increased rudder deflection shall produce increased angles of sideslip. Sufficient bank shall accompany sideslipping to indicate adequately any departure from steady unyawed flight.

(4) Any short-period oscillation occurring between stalling speed and maximum permissible speed shall be heavily damped with the primary controls (i) free and (ii) in a fixed position.

(b) *Two-control (or simplified) airplanes.* (1) The directional stability shall be shown to be adequate by demonstrating that the airplane in all configurations can be rapidly rolled from a 45-degree bank to a 45-degree bank in the opposite direction without exhibiting dangerous skidding characteristics.

(2) Lateral stability shall be shown to be adequate by demonstrating that the airplane will not assume a dangerous attitude or speed when all the controls are abandoned for a period of 2 minutes. This demonstration shall be made in moderately smooth air with the airplane trimmed for straight level flight at 0.9 V_h (or at V_c, if lower), flaps and gear retracted, and with rearward center of gravity loading.

(3) Any short period oscillation occurring between the stalling speed and the maximum permissible speed shall be heavily damped with the primary controls (i) free and (ii) in a fixed position.

§ 3.118–1 *Test conditions (CAA policies which apply to § 3.118 (a) (3)).* The tests made necessary in § 3.118 (a) (3) may be conducted at speeds up to 1.2 times stall speed, flaps up and down, and with power up to 75 percent of maximum continuous rating.

[12 F. R. 3435. Correction noted at 14 F. R. 36]

STALLS

§ 3.120 *Stalling demonstration.* (a) Stalls shall be demonstrated under two conditions:

(1) With power off.

(2) With the power setting not less than that required to show compliance with § 3.85 (a).

(b) In either condition it shall be possible, with flaps and landing gear in any position, with center of gravity in the position least favorable for recovery, and with appropriate airplane weights for: (1) Airplanes having independently controlled rolling and directional controls to produce and to correct roll by unreversed use of the rolling control and to produce and to correct yaw by unreversed use of the directional control during the maneuvers described below up to the time when the airplane pitches, (2) two-control airplanes having either interconnected lateral and directional controls or providing only one of these controls to produce and to correct roll by unreversed use of the rolling control without producing excessive yaw during the maneuvers described below up to the time the airplane pitches.

(c) During the recovery portions of the maneuver, pitch shall not exceed 30 degrees below level, there shall be no loss of altitude in excess of 100 feet, and not more than 15 degrees roll or yaw shall occur when controls are not used for 1 second after pitch starts and are used thereafter only in a normal manner.

(d) Where clear and distinctive stall warning is apparent to the pilot at a speed at least 5 percent above the stalling speed with flaps and landing gear in any position, both in straight and turning flight, these requirements are modified as follows:

(1) It shall be possible to prevent more than 15 degrees roll or yaw by the normal use of controls.

(2) Any loss of altitude in excess of 100 feet or any pitch in excess of 30 degrees below level shall be entered in the Airplane Flight Manual.

(e) In demonstrating the qualities set forth in paragraph (d) of this section, the order of events shall be:

(1) With trim controls adjusted for straight flight at a speed of approximately 1.4 V_{s_1}, reduce speed by means of the elevator control until the speed is steady at slightly above stalling speed, then

(2) Pull elevator control back at a rate such that the airplane speed reduction does not exceed 1 mile per hour per second until a stall is produced as evidenced by an uncontrollable downward pitching motion of the airplane, or until the control reaches the stop. Normal use of the elevator control for recovery may be made after such pitching motion is unmistakably developed.

§ 3.120–1 *Measuring loss of altitude during stall (CAA policies which apply to § 3.120).* To meet the requirements of § 3.120, pertaining to the maximum loss of altitude permitted during the stall, it is necessary that a suitable method be used for the purpose of measuring such loss during the investigation of stalls. Unless special features of an individual type being investigated render the following instructions inapplicable, the procedure described shall be used for this purpose:

(a) The standard procedure for approaching a stall shall be used as specified in § 3.120.

(b) The loss of altitude encountered in the stall (power on or power off) shall be the distance as observed on the sensitive altimeter testing installation from the moment the airplane pitches to the observed altitude reading at which horizontal flight has been regained.

(c) Power used during the recovery portions of a stall maneuver may be that which, at the discretion of the inspector, would be likely used by a pilot under normal operating conditions when executing this particular maneuver. However, the power used to regain level flight shall not be applied until the airplane has regained flying control at a speed of approximately 1.2 V_{s_1}. This means that in the investigation of stalls with the critical engine inoperative, the power may be reduced on the operating engine(s) before reapplying power on the operating engine or engines for the purpose of regaining level flight.

[12 F. R. 3435. Correction rated at 14 F. R. 36]

§ 3.121 *Climbing stalls.* When stalled from an excessive climb attitude it shall be possible to recover from this maneuver without exceeding the limiting air speed or the allowable acceleration limit.

§ 3.122 *Turning flight stalls.* When stalled during a coordinated 30-degree banked turn with 75 percent maximum continuous power on all engines, flaps and landing gear retracted, it shall be possible to recover to normal level flight without encountering excessive loss of altitude, uncontrollable rolling characteristics, or uncontrollable spinning tendencies. These qualities shall be demonstrated by performing the following maneuver: After a steady curvilinear level coordinated flight condition in a 30-degree bank is established and while maintaining the 30-degree bank, the airplane shall be stalled by steadily and progressively tightening the turn with the elevator control until the airplane is stalled or until the elevator has reached its stop. When the stall has fully developed, recovery to level flight shall be made with normal use of the controls.

§ 3.123 *One-engine-inoperative stalls.* Multiengine airplanes shall not display any undue spinning tendency and shall be safely recoverable without applying power to the inoperative engine when stalled with:

(a) The critical engine inoperative,

(b) Flaps and landing gear retracted,

(c) The remaining engines operating at up to 75 percent of maximum continuous power, except that the power need not be greater than that at which the use of maximum control travel just holds the wings laterally level in approaching the stall. The operating engines may be throttled back during the recovery from the stall.

SPINNING

§ 3.124 *Spinning*—(a) *Category N.* All airplanes of 4,000 pounds or less maximum weight shall recover from a one-turn spin with controls assisted to the extent necessary to overcome friction in not more than one and one-half additional turns and without exceeding either the limiting air speed or the limit positive maneuvering load factor for the airplane. It shall not be possible to obtain uncontrollable spins by means of any possible use of the controls. Compliance with the above shall be demonstrated at any permissible combination of weight and center of gravity positions obtainable with all or part of the design useful load. All airplanes in this category, regardless of weight, shall be placarded against spins or demonstrated to be "characteristically incapable of spinning" in which case they shall be so designated. (See paragraph (d) of this section.)

(b) *Category U.* Airplanes in this category shall comply with either the entire requirements of paragraph (a) of this section or the entire requirements of paragraph (c) of this section.

(c) *Category A.* All airplanes in this category must be capable of spinning and shall comply with the following:

(1) At any permissible combination of weight and center of gravity position obtainable with all or part of the design useful load, the airplane shall recover from a six-turn spin with controls free in not more than four additional turns after releasing the controls. If the airplane will not recover as prescribed with controls free but will recover with the controls assisted to the extent necessary to overcome friction, the airplane may be certificated with the rearmost center of gravity position 2 percent forward of the position used in the test.

(2) It shall be possible to recover at any point in the spinning described above by using the controls in a normal manner for that purpose in not more than one and one-half additional turns, and without exceeding either the limiting air speed or the limit positive maneuvering load factor for the airplane. It shall not be possible to obtain uncontrollable spins by means of any possible use of the controls.

(d) *Category NU.* When it is desired to designate an airplane as a type "characteristically incapable of spinning," the flight tests to demonstrate this characteristic shall also be conducted with:

(1) A maximum weight 5 percent in excess of the weight for which approval is desired,

(2) A center of gravity at least 3 percent aft of the rearmost position for which approval is desired,

(3) An available up-elevator travel 4 degrees in excess of that to which the elevator travel is to be limited by appropriate stops.

(4) An available rudder travel 7 degrees, in both directions, in excess of that to which the rudder travel is to be limited by appropriate stops.

GROUND AND WATER CHARACTERISTICS

§ 3.143 *Requirements.* All airplanes shall comply with the requirements of §§ 3.144 to 3.147.

§ 3.144 *Longitudinal stability and control.* There shall be no uncontrollable tendency for landplanes to nose over in any operating condition reasonably expected for the type, or when rebound occurs during landing or take-off. Wheel brakes shall operate smoothly and shall exhibit no undue tendency to induce nosing over. Seaplanes shall exhibit no dangerous or uncontrollable porpoising at any speed at which the airplane is normally operated on the water.

§ 3.145 *Directional stability and control.* (a) There shall be no uncontrollable looping tendency in 90-degree cross winds up to a velocity equal to 0.2 V_{s_0} at any speed at which the aircraft may be expected to be operated upon the ground or water.

(b) All landplanes shall be demonstrated to be satisfactorily controllable with no exceptional degree of skill or alertness on the part of the pilot in power-off landings at normal landing speed and during which brakes or engine power are not used to maintain a straight path.

(c) Means shall be provided for adequate directional control during taxying.

§ 3.146 *Shock absorption.* The shock-absorbing mechanism shall not produce damage to the structure when the airplane is taxied on the roughest ground which it is reasonable to expect the airplane to encounter in normal operation.

§ 3.147 *Spray characteristics.* For seaplanes, spray during taxying, take-off, and landing shall at no time dangerously obscure the vision of the pilots nor produce damage to the propeller or other parts of the airplane.

FLUTTER AND VIBRATION

§ 3.159 *Flutter and vibration.* All parts of the airplane shall be demonstrated to be free from flutter and excessive vibration under all speed and power conditions appropriate to the operation of the airplane up to at least the minimum value permitted for V_d in § 3.184. There shall also be no buffeting condition in any normal flight condition severe enough to interfere with the satisfactory control of the airplane or to cause excessive fatigue to the crew or result in structural damage. However, buffeting as stall warning is considered desirable and discouragement of this type of buffeting is not intended.

SUBPART C—STRENGTH REQUIREMENTS

GENERAL

§ 3.171 *Loads.* (a) Strength requirements are specified in terms of limit and ultimate loads. Limit loads are the maximum loads anticipated in service. Ultimate loads are equal to the limit loads multiplied by the factor of safety. Unless otherwise described, loads specified are limit loads.

(b) Unless otherwise provided, the specified air, ground, and water loads shall be placed in equilibrium with inertia forces, considering all items of mass in the airplane. All such loads shall be distributed in a manner conservatively approximating or closely representing actual conditions. If deflections under load would change significantly the distribution of external or internal loads, such redistribution shall be taken into account.

§ 3.172 *Factor of safety.* The factor of safety shall be 1.5 unless otherwise specified.

§ 3.173 *Strength and deformations.* The structure shall be capable of supporting limit loads without suffering detrimental permanent deformations. At all loads up to limit loads, the deformation shall be such as not to interfere with safe operation of the airplane. The structure shall be capable of supporting ultimate loads without failure for at least 3 seconds, except that when proof of strength is demonstrated by dynamic tests simulating actual conditions of load application, the 3-second limit does not apply.

§ 3.173-1 *Dynamic tests (CAA policies which apply to § 3.173).* (a) Section 3.173 permits dynamic testing in lieu of stress analysis or static testing in the proof of compliance of the structure with strength and deformation requirements. In demonstrating, by dynamic tests, proof of strength of landing gears for the stipulated landing conditions contained in §§ 3.245, 3.246, and 3.247, it is necessary to employ a procedure which will not result in the accepting of landing gears weaker than those qualified for acceptance under present procedures, i. e., stress analysis or static testing.

(b) The Administrator will accept, as an adequate procedure for this purpose, the following dynamic tests:

The structure shall be dropped a minimum of 10 times from the limit drop height, and at least one time from the ultimate drop height, for each basic design condition for which proof of strength is being made by drop tests.

(c) With regard to the extent to which the structure can be proved by dynamic tests, such dynamic tests shall be accepted as proof of strength for only those elements of the structure for which it can be shown that the critical limit and ultimate loads have been reproduced.

[12 F. R. 3435. Correction noted at 14 F. R. 36]

§ 3.174 *Proof of structure.* Proof of compliance of the structure with the strength and deformation requirements of § 3.173 shall be made for all critical loading conditions. Proof of compliance by means of structural analysis will be accepted only when the structure conforms with types for which experience has shown such methods to be reliable. In all other cases substantiating load tests are required. In all cases certain portions of the structure must be subjected to tests as specified in Subpart D.

Flight Loads

§ 3.181 *General.* Flight load requirements shall be complied with at critical altitudes within the range in which the airplane may be expected to operate and at all weights between the minimum design weight and the maximum design weight, with any practicable distribution of disposable load within prescribed operating limitations stated in § 3.777–3.780.

§ 3.182 *Definition of flight load factor.* The flight load factors specified represent the acceleration component (in terms of the gravitational constant g) normal to the assumed longitudinal axis of the airplane, and equal in magnitude and opposite in direction to the airplane inertia load factor at the center of gravity.

SYMMETRICAL FLIGHT CONDITIONS (FLAPS RETRACTED)

§ 3.183 *General.* The strength requirements shall be met at all combinations of air speed and load factor on and within the boundaries of a pertinent V–n diagram, constructed similarly to the one shown in Figure 3–1, which represents the envelope of the flight loading conditions specified by the maneuvering and gust criteria of §§ 3.185 and 3.187. This diagram will also be used in determining the airplane structural operating limitations as specified in Subpart G.

§ 3.184 *Design air speeds.* The design air speeds shall be chosen by the designer except that they shall not be less than the following values:

V_c (design cruising speed)
$= 38\ \sqrt{W/S}$ (NU)
$= 42\ \sqrt{W/S}$ (A)

except that for values of W/S greater than 20, the above numerical multiplying factors shall be decreased linearly with W/S to a value of 33 at $W/S=100$: *And further provided,* That the required minimum value need be no greater than 0.9 V_h actually obtained at sea level.

V_d (design dive speed)
$= 1.40\ V_{c\ \min}$ (N)
$= 1.50\ V_{c\ \min}$ (U)
$= 1.55\ V_{c\ \min}$ (A)

except that for values of W/S greater than 20, the above numerical multiplying factors shall be decreased linearly with W/S to a value of 1.35 at $W/S=100$. ($V_{c\ \min}$ is the required minimum value of design cruising speed specified above.)

V_p (design maneuvering speed)
$= V_s \sqrt{n}$ where:
V_s = a computed stalling speed with flaps fully retracted at the design weight, normally based on the maximum airplane normal force coefficient, C_{NA}.
n = limit maneuvering load factor used in design,

except that the value of V_p need not exceed the value of V_c used in design.

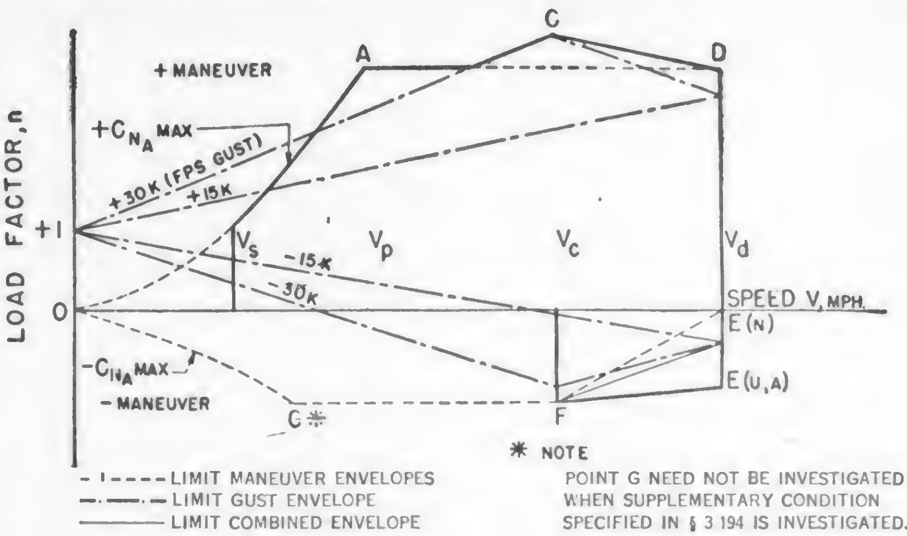


FIG. 3-1—(V-n) DIAGRAM (FLIGHT ENVELOPE)

§ 3.185 *Maneuvering envelope.* The airplane shall be assumed to be subjected to symmetrical maneuvers resulting in the following limit load factors, except where limited by maximum (static) lift coefficients:

(a) The positive maneuvering load factor specified in § 3.186 at all speeds up to V_d.

(b) The negative maneuvering load factor specified in § 3.186 at speed V_c; and factors varying linearly with speed from the specified value at V_c to 0.0 at V_d for the N category and −1.0 at V_d for the A and U categories.

§ 3.186 *Maneuvering load factors.* (a) The positive limit maneuvering load factors shall not be less than the following values (see Fig. 3–2):

$$n = 2.1 + \frac{24{,}000}{W + 10{,}000} \text{ ------------ Category N}$$

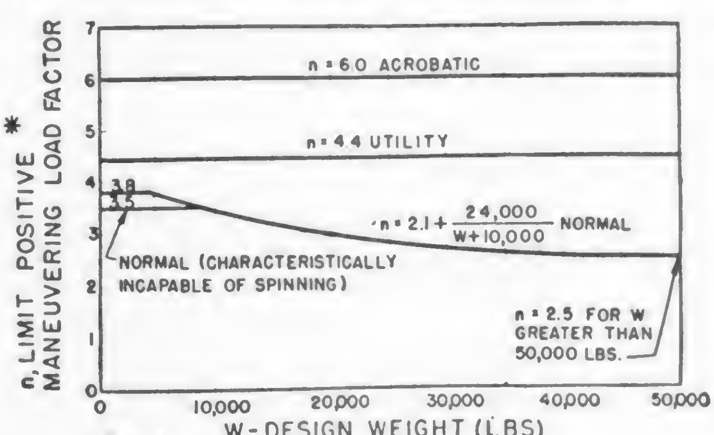
except that n need not be greater than 3.8 and shall not be less than 2.5. For airplanes certificated as characteristically incapable of spinning, n need not exceed 3.5.

$n = 4.4$ -------------------------- Category U
$n = 6.0$ -------------------------- Category A

(b) The negative limit maneuvering load factors shall not be less than −0.4 times the positive load factor for the N and U categories, and shall not be less than −0.5 times the positive load factor for the A category.

(c) Lower values of maneuvering load factor may be employed only if it be proven that the airplane embodies features of design which make it impossible to exceed such values in flight. (See also § 3.106.)

§ 3.186–1 *Use of reduced maneuvering load factors (CAA policies which apply to § 3.186).* In connection with any application to have an aircraft certified for airworthiness under a combination of the requirements of this part and Part 4a of this chapter as authorized by the provisions of § 3.2, reduced maneuvering load factors may be used, provided it is shown that the basic flight envelope for the airplane meets the requirements of the applicable provisions of this part, and that the related operating limitations found in Subpart G are complied with. The actual analysis may be done on the basis of the requirements contained in Part 4a of this chapter. These requirements specify wing load factors. The net load factor for each condition, n_1, should be determined from the balancing computations. This net load factor shall



*NOTE:
LIMIT NEGATIVE MANEUVERING LOAD FACTORS SHALL BE OBTAINED BY MULTIPLYING THE POSITIVE FACTOR VALUES BY .4 FOR NORMAL AND UTILITY CATEGORIES AND BY .5 FOR THE ACROBATIC CATEGORY.

FIG. 3-2—LIMIT MANEUVERING LOAD FACTORS

be equal or greater than the airplane load factor as determined from the Part 3 flight envelope. This analysis procedure may also be used for airplanes certificated entirely under this part.

[12 F. R. 3435. Correction noted at 14 F. R. 36]

§ 3.187 *Gust envelope.* The airplane shall be assumed to encounter symmetrical vertical gusts as specified below while in level flight and the resulting loads shall be considered limit loads:

(a) Positive (up) and negative (down) gusts of 30 feet per second nominal intensity at all speeds up to V_c.

(b) Positive and negative 15 feet per second gusts at V_d. Gust load factors shall be assumed to vary linearly between V_c and V_d.

§ 3.188 *Gust load factors.* In applying the gust requirements, the gust load factors shall be computed by the following formula:

$$n=1+\frac{KUVm}{575\ (W/S)}$$

where: $K=\frac{1}{2}(W/S)^{1/4}$ (for $W/S<16$ p. s. f.)

$=1.33-\frac{2.67}{(W/S)^{3/4}}$ (for $W/S>16$ p.s.f.)

U = nominal gust velocity, f. p. s. (Note that the "effective sharp-edged gust" equals KU.)

V = airplane speed, m. p. h.

m = slope of lift curve, C_L per radian, corrected for aspect ratio.

W/S = wing loading, p. s. f.

§ 3.188-1 *"Slope of lift curve" (CAA interpretations which apply to § 3.188).* For purposes of gust load computations as required in § 3.188 the slope of the lift curve may be assumed equal to that of the wing alone.

[12 F. R. 3435. Correction noted at 14 F. R. 36]

§ 3.189 *Airplane equilibrium.* In determining the wing loads and linear inertia loads corresponding to any of the above specified flight conditions, the appropriate balancing horizontal tail load (see § 3.215) shall be taken into account in a rational or conservative manner.

Incremental horizontal tail loads due to maneuvering and gusts (see §§ 3.216 and 3.217) shall be reacted by angular inertia of the complete airplane in a rational or conservative manner.

FLAPS EXTENDED FLIGHT CONDITIONS

§ 3.190 *Flaps extended flight conditions.* (a) When flaps or similar high lift devices intended for use at the relatively low air speeds of approach, landing, and take-off are installed, the airplane shall be assumed to be subjected to symmetrical maneuvers and gusts with the flaps fully deflected at the design flap speed V_f resulting in limit load factors within the range determined by the following conditions:

(1) Maneuvering, to a positive limit load factor of 2.0.

(2) Positive and negative 15-feet-per-second gusts acting normal to the flight path in level flight. The gust load factors shall be computed by the formula of § 3.188.

V_f shall be assumed not less than 1.4 V_s or 1.8 V_{sf}, whichever is greater, where:

V_s = the computed stalling speed with flaps fully retracted at the design weight

V_{sf} = the computed stalling speed with flaps fully extended at the design weight

except that when an automatic flap load limiting device is employed, the airplane may be designed for critical combinations of air speed and flap position permitted by the device. (See also § 3.338.)

(b) In designing the flaps and supporting structure, slipstream effects shall be taken into account as specified in § 3.223.

NOTE: In determining the external loads on the airplane as a whole, the thrust, slipstream, and pitching acceleration may be assumed equal to zero.

UNSYMMETRICAL FLIGHT CONDITIONS

§ 3.191 *Unsymmetrical flight conditions.* The airplane shall be assumed to be subjected to rolling and yawing maneuvers as described in the following conditions. Unbalanced aerodynamic moments about the center of gravity shall be reacted in a rational or conservative manner considering the principal masses furnishing the reacting inertia forces.

(a) *Rolling conditions.* The airplane shall be designed for (1) unsymmetrical wing loads appropriate to the category, and (2) the loads resulting from the aileron deflections and speeds specified in § 3.222, in combination with an airplane load factor of at least two-thirds of the positive maneuvering factor used in the design of the airplane. Only the wing and wing bracing need be investigated for this condition.

NOTE: These conditions may be covered as noted below:

(a) Rolling accelerations may be obtained by modifying the symmetrical flight conditions shown in Figure 3-1 as follows:

(1) *Acrobatic category.* In conditions A and F assume 100 percent of the wing air load acting on one side of the plane of symmetry and 60 percent on the other.

(2) *Normal and utility categories.* In condition A, assume 100 percent of the wing air load acting on one side of the airplane and 70 percent on the other. For airplanes over 1,000 pounds design weight, the latter percentage may be increased linearly with weight up to 80 percent at 25,000 pounds.

(b) The effect of aileron displacement on wing torsion may be accounted for by adding the following increment to the basic airfoil moment coefficient over the aileron portion of the span in the critical condition as determined by the note under § 3.222:

$$\Delta_{c_m}=-.01\delta$$

where:

Δ_{c_m} = moment coefficient increment

δ = down aileron deflection in degrees in critical condition

(b) *Yawing conditions.* The airplane shall be designed for the yawing loads resulting from the vertical surface loads specified in §§ 3.219 to 3.221.

§ 3.191-1 *Aileron rolling conditions (CAA policies which apply to § 3.191 (a)).* In determining whether airplanes of small to medium size and speed comply with § 3.191 (a), the Administrator will accept the following simplified procedure:

(a) *Steady roll.* Determine the C_n value, corresponding to two-thirds of the symmetrical maneuvering load factor. The C_n distribution over the span may be assumed the same as that for the symmetrical flight conditions. Modify the wing moment coefficient over the aileron portions of the span, as described in the "note" under § 3.191 (a), corresponding to the required aileron deflections. The wing may be critical in torsion on the up as well as the down aileron side, depending upon airfoil section, elastic axis location, aileron differential, etc. (For the up aileron, the moment coefficient increment will be positive.)

(b) *Maximum angular acceleration.* This condition need be investigated only for wings carrying large mass items outboard. In such cases instantaneous aileron deflection (zero rolling velocity) may be assumed and the local value of C_n and C_m over the aileron portions of the span modified accordingly to obtain the spanwise airload distribution. The average C_n of the entire wing should correspond to two-thirds of the symmetrical maneuvering load factor. The resulting rolling moment should be resisted by the rolling inertia of the entire airplane.

[12 F. R. 3435. Correction noted at 14 F. R. 36]

SUPPLEMENTARY CONDITIONS

§ 3.194 *Special condition for rear lift truss.* When a rear lift truss is employed, it shall be designed for conditions of reversed airflow at a design speed of:

$$V=10\sqrt{W/S}+10\ \text{(m. p. h.)}$$

NOTE: It may be assumed that the value of C_L is equal to -0.8 and the chordwise distribution is triangular between a peak at the trailing edge and zero at the leading edge.

§ 3.195 *Engine torque effects.* (a) Engine mounts and their supporting structures shall be designed for engine torque effects combined with certain basic flight conditions as described in subparagraphs (1) and (2) of this paragraph. Engine torque may be neglected in the other flight conditions.

(1) The limit torque corresponding to take-off power and propeller speed acting simultaneously with 75 percent of the limit loads from flight condition A. (See Fig. 3-1.)

(2) The limit torque corresponding to maximum continuous power and propeller speed, acting simultaneously with the limit loads from flight condition A. (See Fig. 3-1.)

(b) The limit torque shall be obtained by multiplying the mean torque by a factor of 1.33 in the case of engines having 5 or more cylinders. For 4-, 3-, and 2-cylinder engines, the factors shall be 2, 3, and 4, respectively.

§ 3.196 *Side load on engine mount.* The limit load factor in a lateral direction for this condition shall be at least equal to one-third of the limit load factor for flight condition A (see Fig. 3-1) except that it shall not be less than 1.33. Engine mounts and their supporting structure shall be designed for this condition which may be assumed independent of other flight conditions.

CONTROL SURFACE LOADS

§ 3.211 *General.* The control surface loads specified in the following sections shall be assumed to occur in the symmetrical and unsymmetrical flight conditions as described in §§ 3.189–3.191. See Figures 3-3 to 3-10 for acceptable values of control surface loadings which are considered as conforming to the following detailed rational requirements.

§ 3.212 *Pilot effort.* In the control surface loading conditions described, the airloads on the movable surfaces and the corresponding deflections need not exceed those which could be obtained in flight by employing the maximum pilot control forces specified in Figure 3-11. In applying this criterion, proper consideration shall be given to the effects of control system boost and servo mechanisms, tabs, and automatic pilot systems in assisting the pilot.

§ 3.212-1 *Automatic pilot systems (CAA policies which apply to § 3.212).* The Administrator will accept the following procedure as giving proper consideration of automatic pilot systems in assisting the pilot under § 3.212: The autopilot effort need not be added to human pilot effort but the autopilot effort shall be used for design if it alone can produce greater control surface loads than the human pilot.

[12 F. R. 3436 Correction noted at 14 F. R. 36]

§ 3.213 *Trim tab effects.* The effects of trim tabs on the control surface design conditions need be taken into account only in cases where the surface loads are limited on the basis of maximum pilot effort. In such cases the tabs shall be considered to be deflected in the direction which would assist the pilot and the deflection shall correspond to the maximum expected degree of "out of trim" at the speed for the condition under consideration.

HORIZONTAL TAIL SURFACES

§ 3.214 *Horizontal tail surfaces.* The horizontal tail surfaces shall be designed for the conditions set forth in §§ 3.215–3.218.

§ 3.215 *Balancing loads.* A horizontal tail balancing load is defined as that necessary to maintain the airplane in equilibrium in a specified flight condition with zero pitching acceleration. The horizontal tail surfaces shall be designed for the balancing loads occurring at any point on the limit maneuvering envelope, Figure 3-1, and in the flap conditions. (See § 3.190.)

NOTE: The distribution of Figure 3-7 may be used.

§ 3.216 *Maneuvering loads.* (a) At maneuvering speed V_p assume a sudden deflection of the elevator control to the maximum upward deflection as limited by the control stops or pilot effort, whichever is critical.

NOTE: The average loading of Figure 3-3 and the distribution of Figure 3-8 may be used. In determining the resultant normal force coefficient for the tail under these conditions, it will be permissible to assume that the angle of attack of the stabilizer with respect to the resultant direction of air flow is equal to that which occurs when the airplane is in steady unaccelerated flight at a flight speed equal to V_p. The maximum elevator deflection can then be determined from the above criteria and the tail normal

Acceptable values of limit average maneuvering control surface loadings can be obtained from Figure 3-3 (b) as follows:

Horizontal Tail Surfaces

(1) Condition § 3.216 (a):
Obtain $\bar{w}$ as function of W/S and surface deflection;
Use Curve C for deflection 10° or less;
Use Curve B for deflection 20°;
Use Curve A for deflection 30° or more;
(Interpolate for other deflections);
Use distribution of Figure 3-8.
(2) Condition § 3.216 (b):
Obtain $\bar{w}$ from Curve B. Use distribution of Figure 3-8.

Vertical Tail Surfaces

(3) Condition § 3.219 (a):
Obtain $\bar{w}$ as function of W/S and surface deflection in same manner as outlined in (1) above, use distribution of Figure 3-8;
(4) Condition § 3.219 (b):
Obtain $\bar{w}$ from Curve C, use distribution of Figure 3-7;
(5) Condition § 3.219 (c):
Obtain $\bar{w}$ from Curve A, use distribution of Figure 3-9. (Note that condition § 3.220 generally will be more critical than this condition.)

Ailerons

(6) In lieu of conditions § 3.222 (b):
Obtain $\bar{w}$ from Curve B, acting in both up and down directions.
Use distribution of Figure 3-10.

FIG. 3-3(a)—LIMIT AVERAGE MANEUVERING CONTROL SURFACE LOADINGS

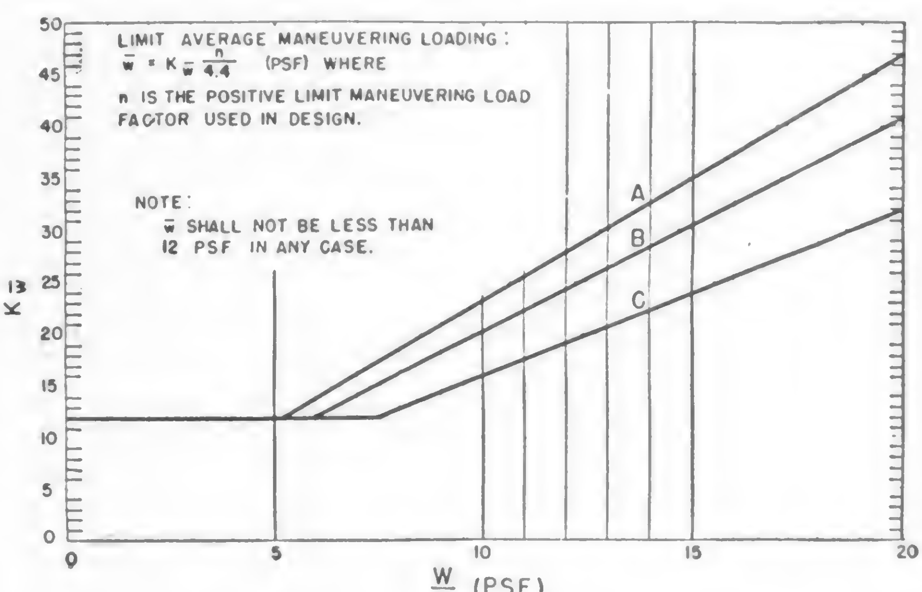


FIG. 3-3(b)—LIMIT AVERAGE MANEUVERING CONTROL SURFACE LOADING

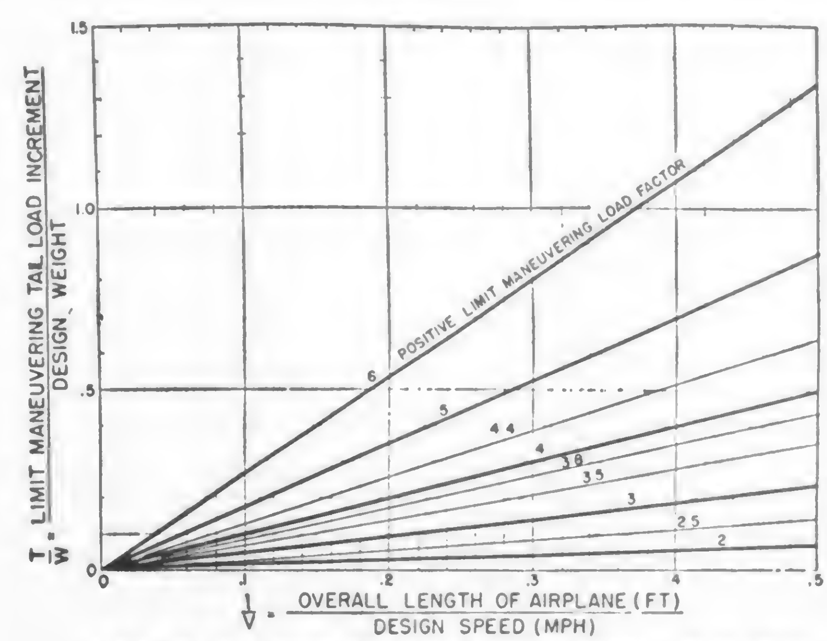


FIG. 3-4 —— MANEUVERING TAIL LOAD INCREMENT (UP OR DOWN)

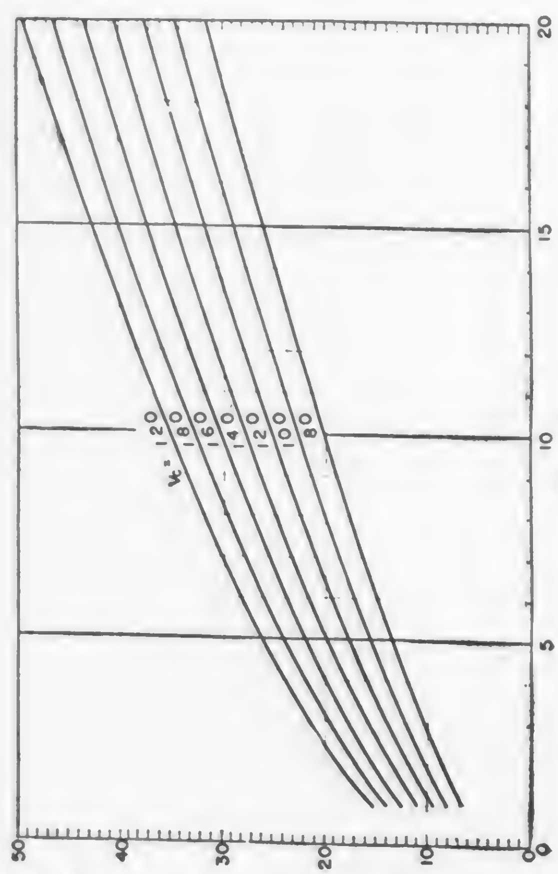


FIG. 3-5(a)——DOWN GUST LOADING ON HORIZONTAL TAIL SURFACE

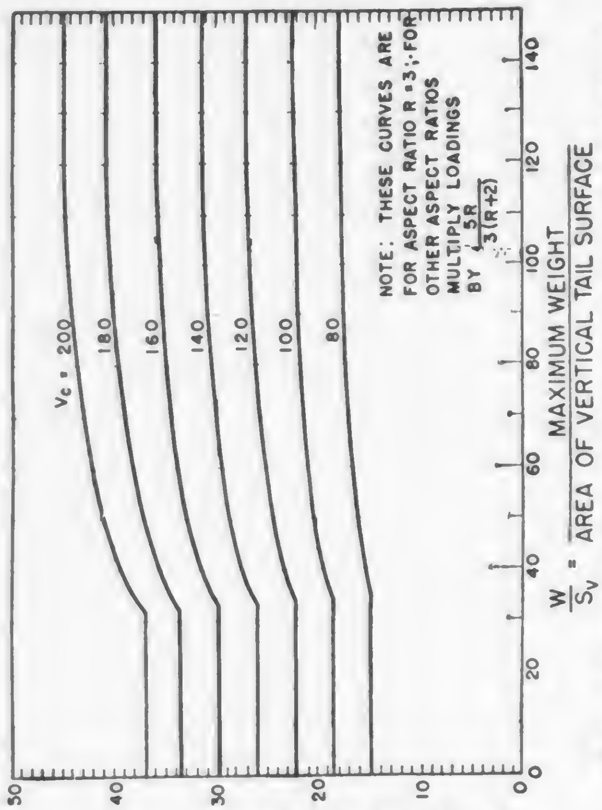


FIG. 3-6——GUST LOADING ON VERTICAL TAIL SURFACE

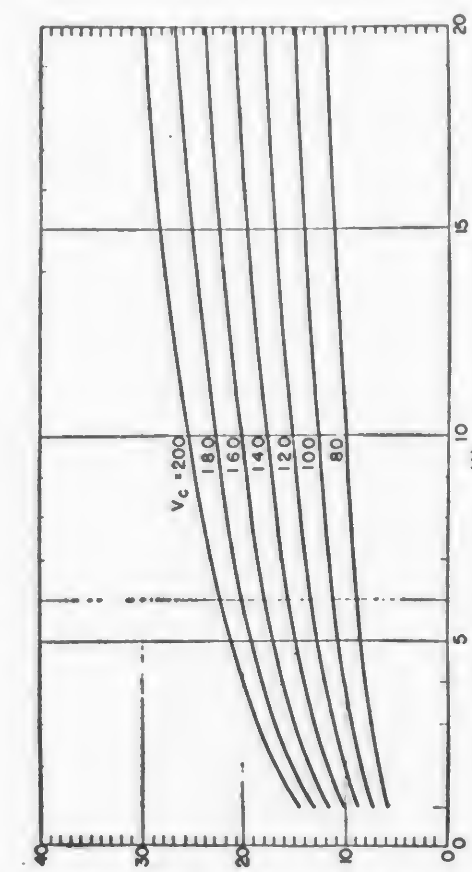


FIG. 3-5(b) —— UP GUST LOADING ON HORIZONTAL TAIL SURFACE

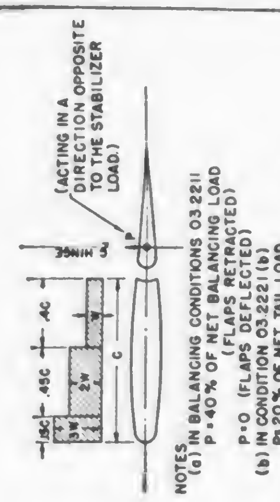


FIG. 3-7 TAIL SURFACE LOAD DISTRIBUTION

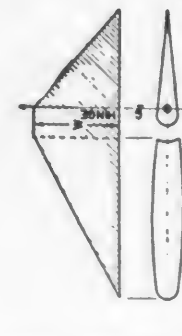


FIG. 3-8 TAIL SURFACE LOAD DISTRIBUTION

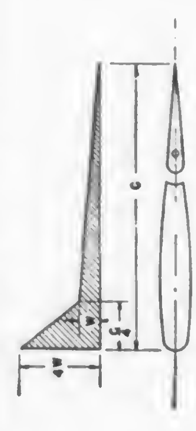


FIG. 3-9 TAIL SURFACE LOAD DISTRIBUTION

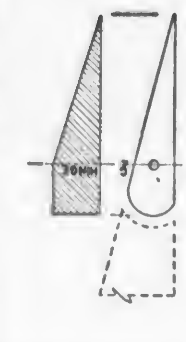


FIG. 3-10 AILERON LOAD DISTRIBUTION

force coefficient can be obtained from the data given in NACA Report No. 688, "Aerodynamic Characteristics of Horizontal Tail Surfaces," or other applicable NACA reports.

(b) Same as case (a) except that the elevator deflection is downward.

NOTE: The average loading of Figure 3-3 and the distribution of Figure 3-8 may be used.

(c) At all speeds above V_p the horizontal tail shall be designed for the maneuvering loads resulting from a sudden upward deflection of the elevator, followed by a downward deflection of the elevator such that the following combinations of normal acceleration and angular acceleration are obtained:

Condition	Airplane normal acceleration n	Angular acceleration radian/sec.²
Down load	1.0	$+\frac{45}{V} n_m (n_m-1.5)$
Up load	n_m	$-\frac{45}{V} n_m (n_m-1.5)$

where:

n_m = positive limit maneuvering load factor used in the design of the airplane.

V = initial speed in miles per hour.

(d) The total tail load for the conditions specified in (c) shall be the sum of: (1) The balancing tail load corresponding with the condition at speed V and the specified value of the normal load factor n, plus (2) the maneuvering load increment due to the specified value of the angular acceleration.

NOTE: The maneuvering load increment of Figure 3-4 and the distributions of Figure 3-8 (for downloads) and Figure 3-9 (for uploads) may be used. These distributions apply to the total tail load.

§ 3.217 *Gust loads.* The horizontal tail surfaces shall be designed for loads occurring in the following conditions:

(a) Positive and negative gusts of 30 feet per second nominal intensity at speed V_c, corresponding to flight condition § 3.187 (a) with flaps retracted.

NOTE: The average loadings of Figures 3-5 (a) and 3-5 (b) and the distribution of Figure 3-9 may be used for the total tail loading in this condition.

(b) Positive and negative gusts of 15 feet per second nominal intensity at speed V_f, corresponding to flight condition § 3.190 (b) with flaps extended. In determining the total load on the horizontal tail for these conditions, the initial balancing tail loads shall first be determined for steady unaccelerated flight at the pertinent design speeds V_c and V_f. The incremental tail load resulting from the gust shall then be added to the initial balancing tail load to obtain the total tail load.

NOTE: The incremental tail load due to the gust may be computed by the following formula:

$$\Delta t = 0.1\ KUVS_t a_t \left(1 - \frac{36 a_w}{R_w}\right)$$

where:

Δt = the limit gust load increment on the tail in pounds;

K = gust coefficient K in § 3.188,

U = nominal gust intensity in feet per second,

V = airplane speed in miles per hour,

S_t = tail surface area in square feet,

a_t = slope of lift curve of tail surface, C_L per degree, corrected for aspect ratio,

a_w = slope of lift curve of wing, C_L per degree,

R_w = aspect ratio of the wing.

§ 3.218 *Unsymmetrical loads.* The maximum horizontal tail surface loading (load per unit area), as determined by the preceding sections, shall be applied to the horizontal surfaces on one side of the plane of symmetry and the following percentage of that loading shall be applied on the opposite side:

% = 100–10 (n–1) where:
n is the specified positive maneuvering load factor.

In any case the above value shall not be greater than 80 percent.

VERTICAL TAIL SURFACES

§ 3.219 *Maneuvering loads.* At all speeds up to V_p:

(a) With the airplane in unaccelerated flight at zero yaw, a sudden displacement of the rudder control to the maximum deflection as limited by the control stops or pilot effort, whichever is critical, shall be assumed.

NOTE: The average loading of Figure 3-3 and the distribution of Figure 3-8 may be used.

(b) The airplane shall be assumed to be yawed to a sideslip angle of 15 degrees while the rudder control is maintained at full deflection (except as limited by pilot effort) in the direction tending to increase the sideslip.

NOTE: The average loading of Figure 3-3 and the distribution of Figure 3-7 may be used.

(c) The airplane shall be assumed to be yawed to a sideslip angle of 15 degrees while the rudder control is maintained in the neutral position (except as limited by pilot effort). The assumed sideslip angles may be reduced if it is shown that the value chosen for a particular speed cannot be exceeded in the cases of steady slips, uncoordinated rolls from a steep bank, and sudden failure of the critical engine with delayed corrective action.

NOTE: The average loading of Figure 3-3 and the distribution of Figure 3-9 may be used.

§ 3.220 *Gust loads.* (a) The airplane shall be assumed to encounter a gust of 30 feet per second nominal intensity, normal to the plane of symmetry while in unaccelerated flight at speed V_c.

(b) The gust loading shall be computed by the following formula:

$$\overline{w} = \frac{KUVm}{575}$$

where:

$\overline{w}$ = average limit unit pressure in pounds per square foot,

$K = 1.33 - \frac{4.5}{(W/S_v)^{3/4}}$, except that K shall not be less than 1.0. A value of K obtained by rational determination may be used.

U = nominal gust intensity in feet per second,

V = airplane speed in miles per hour,

m = slope of lift curve of vertical surface, C_L per radian, corrected for aspect ratio,

W = design weight in pounds,

S_v = vertical surface area in square feet.

(c) This loading applies only to that portion of the vertical surfaces having a well-defined leading edge.

NOTE: The average loading of Figure 3-6 and the distribution of Figure 3-9 may be used.

§ 3.221 *Outboard fins.* When outboard fins are carried on the horizontal tail surface, the tail surfaces shall be designed for the maximum horizontal surface load in combination with the corresponding loads induced on the vertical surfaces by end plate effects. Such induced effects need not be combined with other vertical surface loads. When outboard fins extend above and below the horizontal surface, the critical vertical surface loading (load per unit area) as determined by §§ 3.219 and 3.220 shall be applied:

(a) To the portion of the vertical surfaces above the horizontal surface, and 80 percent of that loading applied to the portion below the horizontal surface,

(b) To the portion of the vertical surfaces below the horizontal surface, and 80 percent of that loading applied to the portion above the horizontal surface.

AILERONS, WING FLAPS, TABS, ETC.

§ 3.222 *Ailerons.* (a) In the symmetrical flight conditions (see §§ 3.183–3.189), the ailerons shall be designed for all loads to which they are subjected while in the neutral position.

(b) In unsymmetrical flight conditions (see § 3.191 (a)), the ailerons shall be designed for the loads resulting from the following deflections except as limited by pilot effort:

(1) At speed V_p it shall be assumed that there occurs a sudden maximum displacement of the aileron control. (Suitable allowance may be made for control system deflections.)

(2) When V_c is greater than V_p, the aileron deflection at V_c shall be that required to produce a rate of roll not less than that obtained in condition (1).

(3) At speed V_d the aileron deflection shall be that required to produce a rate of roll not less than one-third of that which would be obtained at the speed and aileron deflection specified in condition (1).

NOTE: For conventional ailerons, the deflections for conditions (2) and (3) may be computed from:

$$\delta_2 = \frac{V_p}{V_c}\delta_1; \qquad \text{and } \delta_3 = \frac{0.5\ V_p}{V_d}\delta_1;$$

where:

δ_1 = total aileron deflection (sum of both aileron deflections) in condition (1).

δ_2 = total aileron deflection in condition (2).

δ_3 = total deflection in condition (3). In the equation for δ_3, the 0.5 factor is used instead of 0.33 to allow for wing torsional flexibility.

(c) The critical loading on the ailerons should occur in condition (2) if V_d is less than $2V_c$ and the wing meets the torsional stiffness criteria. The normal force coefficient C_N for the ailerons may be taken as 0.04δ, where δ is the deflection of the individual aileron in degrees. The critical condition for wing torsional loads will depend upon the basic airfoil moment coefficient as well as the speed, and may be determined as follows:

$$\frac{T_3}{T_2}=\frac{(C_m-.01\delta_{3_1})V_d^2}{(C_m-.01\delta_{2_1})V_c^2}$$

where:

T_3/T_2 is the ratio of wing torsion in condition (b) (3) to that in condition (b) (2).

δ_{2_1} and δ_{3_1} are the down deflections of the individual aileron in conditions (b) (2) and (3) respectively.

(d) When T_3/T_2 is greater than 1.0 condition (b) (3) is critical; when T_3/T_2 is less than 1.0 condtion (b) (2) is critical.

(e) In lieu of the above rational conditions the average loading of Figure 3–3 and the distribution of Figure 3–10 may be used.

§ 3.223 *Wing flaps.* Wing flaps, their operating mechanism, and supporting structure shall be designed for critical loads occurring in the flap-extended flight conditions (see § 3.190) with the flaps extended to any position from fully retracted to fully extended; except that when an automatic flap load limiting device is employed these parts may be designed for critical combinations of air speed and flap position permitted by the device. (Also see §§ 3.338 and 3.339.) The effects of propeller slipstream corresponding to take-off power shall be taken into account at an airplane speed of not less than 1.4 V_s where V_s is the computed stalling speed with flaps fully retracted at the design weight. For investigation of the slipstream condition, the airplane load factor may be assumed to be 1.0.

§ 3.224 *Tabs.* Control surface tabs shall be designed for the most severe combination of air speed and tab deflection likely to be obtained within the limit *V–n* diagram (Fig. 3–1) for any usable loading condition of the airplane.

§ 3.225 *Special devices.* The loading for special devices employing aerodynamic surfaces, such as slots and spoilers, shall be based on test data.

CONTROL SYSTEM LOADS

§ 3.231 *Primary flight controls and systems.* (a) Flight control systems and supporting structures shall be designed for loads corresponding to 125 percent of the computed hinge moments of the movable control surface in the conditions prescribed in §§ 3.211 to 3.225, subject to the following maxima and minima:

(1) The system limit loads need not exceed those which can be produced by the pilot and automatic devices operating the controls.

(2) The loads shall in any case be sufficient to provide a rugged system for service use, including consideration of jamming, ground gusts, taxying tail to wind, control inertia, and friction.

(b) Acceptable maximum and minimum pilot loads for elevator, aileron, and rudder controls are shown in Figure 3–11. These pilot loads shall be assumed to act at the appropriate control grips or pads in a manner simulating flight conditions and to be reacted at the attachments of the control system to the control surface horn.

§ 3.231–1 *Hinge moments (CAA policies which apply to § 3.231).* The 125 percent factor on computed hinge moments provided in § 3.231 (a) need be applied only to elevator, aileron and rudder systems. The Administrator will accept a factor as low as 1.0 when hinge moments are based on test data, the exact reduction which the Administrator will accept, depending to an extent upon the accuracy and reliability of the data.

[12 F. R. 3436. Correction noted at 14 F. R. 36]

§ 3.231–2 *System limit loads (CAA policies which apply to § 3.231 (a) (1)).* The Administrator will accept the following procedure as compliance with § 3.231 (a) (1): When the autopilot is acting in conjunction with the human pilot, the autopilot effort need not be added to human pilot effort but the autopilot effort shall be used for design if it alone can produce greater control surface loads than the human pilot. When the human pilot acts in opposition to the autopilot, that portion of the system between them shall be designed for the maximum effort of human pilot or autopilot, whichever is the lesser.

[12 F. R. 3436. Correction noted at 14 F. R. 36]

§ 3.232 *Dual controls.* When dual controls are provided, the systems shall be designed for the pilots operating in opposition, using individual pilot loads equal to 75 percent of those obtained in accordance with § 3.231, except that the individual pilot loads shall not be less than the minimum loads specified in Figure 3–11.

§ 3.233 *Ground gust conditions.* (a) The following ground gust conditions shall be investigated in cases where a deviation from the specific values for minimum control forces listed in Figure 3–11 is applicable. The following conditions are intended to simulate the loadings on control surfaces due to ground gusts and when taxying with the wind.

(b) The limit hinge moment H shall be obtained from the following formula:

$$H=K_cSq$$

where:

H=limit hinge moment (foot-pounds).

c=mean chord of the control surface aft of the hinge line (feet).

S=area of control surface aft of the hinge line (square feet).

q=dynamic pressure (pounds per square foot) to be based on a design speed not less than $10\sqrt{W/S}+10$ miles per hour, except that the design speed need not exceed 60 miles per hour.

K=factor as specified below:

Surface	*K*
(a) Aileron	+0.75
Control column locked or lashed in mid-position.	
(b) Aileron	±0.50
Ailerons at full throw; + moment on one aileron, − moment on the other.	
(c) (d) Elevator	±0.75
Elevator (c) full up (−), and (d) full down (+).	
(e) (f) Rudder	±0.75
Rudder (e) in neutral, and (f) at full throw.	

(c) As used in paragraph (b) in connection with ailerons and elevators, a positive value of K indicates a moment tending to depress the surface while a negative value of K indicates a moment tending to raise the surface.

§ 3.233–1 *Ground gust loads (CAA policies which apply to § 3.233).* Section 3.233 requires ground gust loads to be investigated when a reduction in minimum pilot effort loads is desired. In such cases the entire system shall be investigated for ground gust loads. However, in instances where the designer desires to investigate ground gust loads without intending to reduce pilot effort loads, the ground gust load need be carried only from the control surface horn to the nearest stops or gust locks, including the stops or locks and their supporting structures.

[12 F. R. 3436. Correction noted at 14 F. R. 36]

§ 3.234 *Secondary controls and systems.* Secondary controls, such as wheel brakes, spoilers, and tab controls, shall be designed for the loads based on the maximum which a pilot is likely to apply to the control in question.

LIMIT PILOT LOADS

Control	Maximum loads for design weight W equal to or less than 5,000 lbs.[1]	Minimum loads[2]
Aileron:		
Stick	67 pounds	40 pounds.
Wheel[3]	53 D in-pounds[4]	40 D in-pounds.
Elevator:		
Stick	167 pounds	100 pounds.
Wheel	200 pounds	100 pounds.
Rudder	200 pounds	130 pounds.

[1] For design weight W greater than 5,000 pounds the above specified maximum values shall be increased linearly with weight to 1.5 times the specified values at a design weight of 25,000 pounds.

[2] If the design of any individual set of control systems or surfaces is such as to make these specified minimum loads inapplicable, values corresponding to the pertinent hinge moments obtained according to § 3.233 may be used instead, except that in any case values less than 0.6 of the specified minimum loads shall not be employed.

[3] The critical portions of the aileron control system shall also be designed for a single tangential force having a limit value equal to 1.25 times the couple force determined from the above criteria.

[4] D=wheel diameter.

FIG. 3-11—PILOT CONTROL FORCE LIMITS

GROUND LOADS

§ 3.241 *Ground loads.* The loads specified in the following conditions shall be considered as the external loads and inertia forces which would occur in an airplane structure if it were acting as a rigid body. In each of the ground load conditions specified the external reactions shall be placed in equilibrium with the linear and angular inertia forces in a rational or conservative manner.

§ 3.242 *Design weight.* The design weight used in the landing conditions shall not be less than the maximum weight for which certification is desired: *Provided, however,* That for multiengine airplanes meeting the one-engine-inoperative climb requirement of § 3.85 (b), the airplane may be designed for a design landing weight which is less than the maximum design weight, if compliance is shown with the following sections of Part 4b in lieu of the corresponding requirements of this part: the ground load requirements of § 4b.241, and shock absorption requirements of § 4b.371 and its related sections, the wheel and tire requirements of §§ 4b.391 and 4b.392, and the fuel jettisoning system requirements of § 4b.536.

§ 3.243 *Load factor for landing conditions.* In the following landing conditions the limit vertical inertia load factor at the center of gravity of the airplane shall be chosen by the designer but shall not be less than the value which would be obtained when landing the airplane with a descent velocity, in feet per second, equal to the following value:

$$V=4.4\ (W/S)^{1/4}$$

except that the descent velocity need not exceed 10 feet per second and shall not be less than 7 feet per second. Wing lift not exceeding two-thirds of the weight of the airplane may be assumed to exist throughout the landing impact and may be assumed to act through the airplane center of gravity. When such wing lift is assumed, the ground reaction load factor may be taken equal to the inertia load factor minus the ratio of the assumed wing lift to the airplane weight. (See § 3.354 for requirements concerning the energy absorption tests which determine the limit load factor corresponding to the required limit descent velocities.) In no case, however, shall the inertia load factor used for design purposes be less than 2.67, nor shall the limit ground reaction load factor be less than 2.0, unless it is demonstrated that lower values of limit load factor will not be exceeded in taxying the airplane over terrain having the maximum degree of roughness to be expected under intended service use at all speeds up to take-off speed.

LANDING CASES AND ATTITUDES

§ 3.244 *Landing cases and attitudes.* For conventional arrangements of main and nose, or main and tail wheels, the airplane shall be assumed to contact the ground at the specified limit vertical velocity in the attitudes described in §§ 3.245–3.247. (See Figs. 3–12 (a) and 3–12 (b) for acceptable landing conditions which are considered to conform with §§ 3.245–3.247.)

§ 3.245 *Level landing*—(a) *Tail wheel type.* Normal level flight attitude.

(b) *Nose wheel type.* Two cases shall be considered:

(1) Nose and main wheels contacting the ground simultaneously,

(2) Main wheels contacting the ground, nose wheel just clear of the ground. (The angular attitude may be assumed the same as in subparagraph (1) of this paragraph for purposes of analysis.)

(c) *Drag components.* In this condition, drag components simulating the forces required to accelerate the tires and wheels up to the landing speed shall be properly combined with the corresponding instantaneous vertical ground reactions. The wheel spin-up drag loads may be based on vertical ground reactions, assuming wing lift and a tire-sliding coefficient of friction of 0.8, but in any case the drag loads shall not be less than 25 percent of the maximum vertical ground reactions neglecting wing lift.

§ 3.245–1 *Wheel spin-up loads (CAA policies which apply to § 3.245).* (a) Section 3.245 requires that spin-up loads be taken into account in structural designs. Section 3.244 permits the use of arbitrary drag loads for this purpose.

(b) If it is desired to use a method more rational than the arbitrary drag components referred to in § 3.244 in determining the wheel spin-up loads for landing conditions, the Administrator will accept the following method from NACA T. N. 863 for this purpose (however, the minimum drag component of

Condition	Tail wheel type		Nose wheel type		
	Level landing	Tail-down landing	Level landing with inclined reactions	Level landing with nose wheel just clear of ground	Tail-down landing
Reference section	§ 3.245 (a)	§ 3.246 (a)	§ 3.245 (b) (1)	§ 3.245 (b) (2)	§ 3.246(b)(c)
Vertical component at c. g	nW	nW	nW	nW	nW
Fore and aft component at c. g	KnW	0	KnW	KnW	0
Lateral component in either direction at c. g.	0	0	0	0	0
Shock absorber extension (hydraulic shock absorber)	Note (2)	Note (2)	Note (2)	Note (2)	Note (2)
Shock absorber deflection (rubber or spring shock absorber)	100%	100%	100%	100%	100%
Tire deflection	Static	Static	Static	Static	Static
Main wheel loads (both wheels) V_r	nW	$nW\ b/d$	$nW\ b'/d'$	nW	nW
Main wheel loads (both wheels) D_r	KV_r	0	KV_r	KV_r	0
Tail (nose) wheel loads V_f	0	$nW\ a/d$	$nW\ a'/d'$	0	0
Tail (nose) wheel loads D_f	0	0	KV_f	0	0
Notes	(1) and (3)		(1)	(1) and (3)	(3)

NOTE (1).—K may be determined as follows: $K=0.25$ for $W=3{,}000$ pounds or less; $K=0.33$ for $W=6{,}000$ pounds or greater, with linear variation of K between these weights.

NOTE (2).—For the purpose of design, the maximum load factor shall be assumed to occur throughout the shock absorber stroke from 25 percent deflection to 100 percent deflection unless demonstrated otherwise, and the load factor shall be used with whatever shock absorber extension is most critical for each element of the landing gear.

NOTE (3).—Unbalanced moments shall be balanced by a rational or conservative method.

FIG. 3-12(a)—BASIC LANDING CONDITIONS

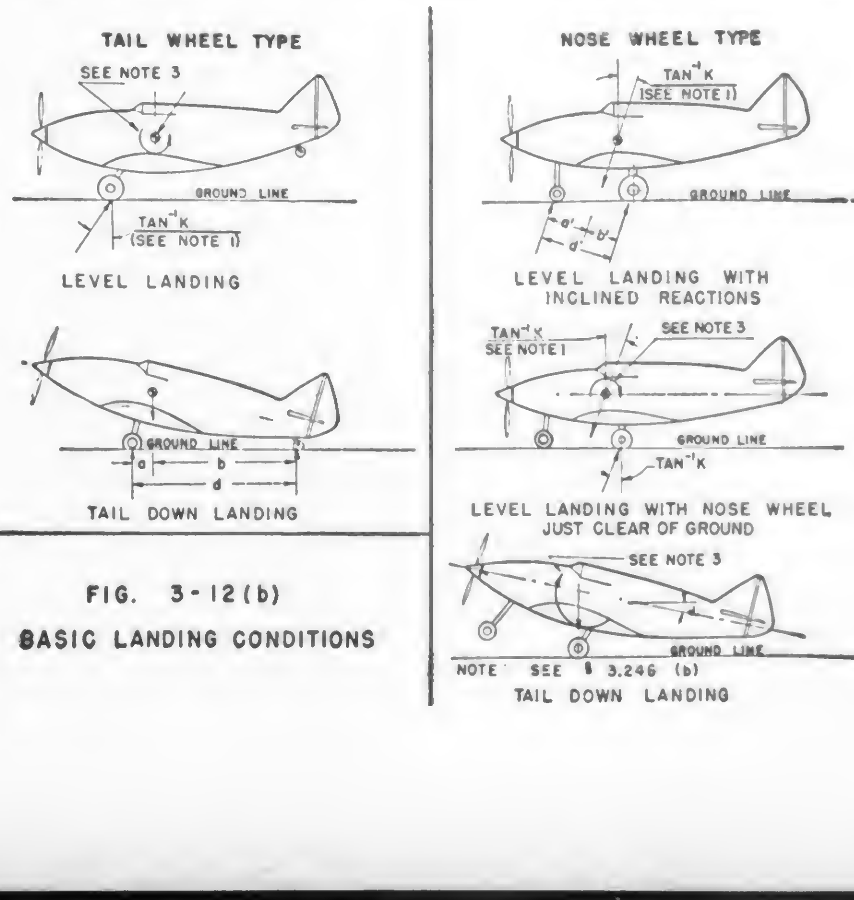


FIG. 3-12 (b)
BASIC LANDING CONDITIONS

0.25 times the vertical component will still apply):

$$F_{H_{max}}=\frac{1}{r_e}\sqrt{\frac{2I_w(V_H-V_c)nF_{V_{max}}}{t_z}}.$$

where:

$F_{H_{max}}$ = maximum rearward horizontal force acting on the wheel-pounds.

r_e = effective rolling radius of wheel under impact-feet based on recommended operating tire pressure (may be assumed equal to the rolling radius under a static load of n_jW_e).

I_w = rotational mass moment of interia of rolling assembly slug feet required.

V_H = linear velocity of airplane parallel to ground at instant of contact, assumed 1.2 V_{s_0}, in feet per second.

V_c = peripheral speed of tire if pre-rotation is used (feet per second)—a positive means of pre-rotation should be provided before pre-rotation can be considered.

n = effective coefficient of friction; 0.80 is acceptable.

$F_{V_{max}}$ = maximum vertical force on wheel (pounds) = n_jW_e, where W_e and n_j are defined in §§ 3.353 and 3.354.

t_z = time interval between ground contact and attainment of maximum vertical force on wheel (seconds). If the value of $F_{H_{max}}$ from the above equation exceeds 0.8 $F_{V_{max}}$, the latter value should be used $F_{H_{max}}$.

NOTE: This equation assumes a linear variation of load factor with time until the peak load is reached and under this assumption determines the drag force at the time that the wheel peripheral velocity at radius r_e equals the airplane velocity. Most shock absorbers do not exactly follow a linear variation of load factor with time. Hence, rational or conservative allowances should be made to compensate for these variations. On most landing gears the time for wheel spin-up will be less than the time required to develop maximum vertical load factor for the specified rate of descent and forward velocity. However, for exceptionally large wheels, a wheel peripheral velocity equal to the ground speed may not have been attained at time of maximum vertical gear load. This case is covered by the statement above that the drag spin-up load need not exceed 0.8 of the maximum vertical load

(b) Dynamic spring-back of the landing gear and adjacent structure at the instant just after the wheels come up to speed may result in dynamic forward acting loads of considerable magnitude. This effect may be simulated in the level landing condition by assuming that the wheel spin-up loads are reversed. Dynamic spring-back is likely to be critical only for landing gear units having wheels of large mass supported by relatively flexible cantilever struts.

(c) The arbitrary drag loads referred to in § 3.244 (Fig. 3-12) are usually sufficient to provide for wheel spin-up except for airplanes having large diameter wheels or high stalling speeds. For the latter, it is recommended that a more rational investigation, such as that described above, be made.

[12 F. R. 3436. Correction noted at 14 F. R. 36]

§ 3.246 *Tail down*—(a) *Tail wheel type.* Main and tail wheels contacting ground simultaneously.

(b) *Nose wheel type.* Stalling attitude or the maximum angle permitting clearance of the ground by all parts of the airplane, whichever is the lesser.

(c) *Vertical ground reactions.* In this condition, it shall be assumed that the ground reactions are vertical, the wheels having been brought up to speed before the maximum vertical load is attained.

§ 3.247 *One-wheel landing.* One side of the main gear shall contact the ground with the airplane in the level attitude. The ground reactions shall be the same as those obtained on the one side in the level attitude. (See § 3.245.)

GROUND ROLL CONDITIONS

§ 3.248 *Braked roll.* The limit vertical load factor shall be 1.33. The attitude and ground contacts shall be those described for level landings in § 3.245, with the shock absorbers and tires deflected to their static positions. A drag reaction equal to the vertical reaction at the wheel multiplied by a coefficient of friction of 0.8 shall be applied at the ground contact point of each wheel having brakes, except that the drag reaction need not exceed the maximum value based on limiting brake torque.

§ 3.249 *Side load.* Level attitude with main wheels only contacting the ground, with the shock absorbers and tires deflected to their static positions. The limit vertical load factor shall be 1.33 with the vertical ground reaction divided equally between main wheels. The limit side inertia factor shall be 0.83 with the side ground reaction divided between main wheels as follows:

0.5W acting inboard on one side.
0.33W acting outboard on the other side.

TAIL WHEELS

§ 3.250 *Supplementary conditions for tail wheels.* The conditions in §§ 3.251 and 3.252 apply to tail wheels and affected supporting structure.

§ 3.251 *Obstruction load.* The limit ground reaction obtained in the tail down landing condition shall be assumed to act up and aft through the axle at 45 degrees. The shock absorber and tire may be assumed deflected to their static positions.

§ 3.252 *Side load.* A limit vertical ground reaction equal to the static load on the tail wheel, in combination with a side component of equal magnitude. When a swivel is provided, the tail wheel shall be assumed swiveled 90 degrees to the airplane longitudinal axis, the resultant ground load passing through the axle. When a lock steering device or shimmy damper is provided, the tail wheel shall also be assumed in the trailing position with the side load acting at the ground contact point. The shock absorber and tire shall be assumed deflected to their static positions.

NOSE WHEELS

§ 3.253 *Supplementary conditions for nose wheels.* The conditions set forth in §§ 3.254–3.256 apply to nose wheels and affected supporting structure. The shock absorbers and tires shall be assumed deflected to their static positions.

§ 3.254 *Aft load.* Limit force components at axle:

Vertical, 2.25 times static load on wheel.
Drag, 0.8 times vertical load.

§ 3.255 *Forward load.* Limit force components at axle:

Vertical, 2.25 times static load on wheel.
Forward, 0.4 times vertical load.

§ 3.256 *Side load.* Limit force components at ground contact:

Vertical, 2.25 times static load on wheel.
Side, 0.7 times vertical load.

SKIPLANES

§ 3.257 *Supplementary conditions for skiplanes.* The airplane shall be assumed resting on the ground with one main ski frozen in the snow and the other main ski and the tail ski free to slide. A limit side force equal to $P/3$ shall be applied at the most convenient point near the tail assembly, where P is the static ground reaction on the tail ski. For this condition the factor of safety shall be assumed equal to 1.0.

WATER LOADS

§ 3.265 *General.* The requirements set forth in §§ 3.266–3.282 shall apply to the entire airplane, but have particular reference to hull structure, wing, nacelles, and float supporting structure.

DESIGN WEIGHT

§ 3.266 *Design weight.* The design weight used in the water landing conditions shall not be less than the maximum weight for which certification is desired for any operation.

BOAT SEAPLANES

§ 3.267 *Local bottom pressures*—(a) *Maximum local pressure.* The maximum value of the limit local pressure shall be determined from the following equation:

$$P_{max}=0.055\ V_{s_0}\ ^{1.4}\ (1+\frac{W}{50{,}000})^{1/4}$$

where

P = pressure in pound per square inch.

V_{s_0} = stalling speed, flaps down, power off, in miles per hour (to be calculated on the basis of wind tunnel data or flight tests on previous airplanes).

W = design weight.

(b) *Variation in local pressure.* The local pressures to be applied to the hull bottom shall vary in accordance with Figure 3–13. No variation from keel to chine (beamwise) shall be assumed, except when the chine flare indicates the advisability of higher pressures at the chine.

(c) *Application of local pressure.* The local pressures determined in paragraphs (a) and (b) of this section shall be applied over a local area in such a manner as to cause the maximum local loads in the hull bottom structure.

§ 3.268 *Distributed bottom pressures.* (a) For the purpose of designing frames, keels, and chine structure, the limit pressures obtained from § 3.267 and Figure 3–13 shall be reduced to one-half the local values and simultaneously applied over the entire hull bottom. The loads so obtained shall be carried into the side-wall structure of the hull proper, but need not be transmitted in a fore-and-aft direction as shear and bending loads.

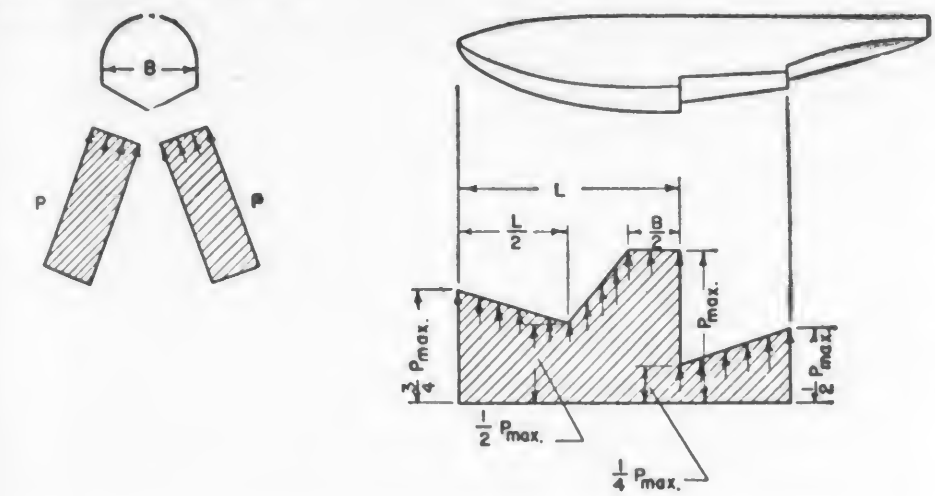


FIG. 3-13 DISTRIBUTION OF LOCAL PRESSURES (BOAT SEAPLANES)

(b) *Unsymmetrical loading.* Each floor member or frame shall be designed for a load on one side of the hull center line equal to the most critical symmetrical loading, combined with a load on the other side of the hull center line equal to one-half of the most critical symmetrical loading.

§ 3.269 *Step loading condition*—(a) *Application of load.* The resultant water load shall be applied vertically in the plane of symmetry so as to pass through the center of gravity of the airplane.

(b) *Acceleration.* The limit acceleration shall be 4.33.

(c) *Hull shear and bending loads.* The hull shear and bending loads shall be computed from the inertia loads produced by the vertical water load. To avoid excessive local shear loads and bending moments near the point of water load application, the water load may be distributed over the hull bottom, using pressures not less than those specified in § 3.268.

§ 3.270 *Bow loading condition*—(a) *Application of load.* The resultant water load shall be applied in the plane of symmetry at a point one-tenth of the distance from the bow to the step and shall be directed upward and rearward at an angle of 30 degrees from the vertical.

(b) *Magnitude of load.* The magnitude of the limit resultant water load shall be determined from the following equation:

$$P_b=\frac{n_s W_e}{2.}$$

where:

P_b = the load in pounds.
n_s = the step landing load factor.
W_e = an effective weight which is assumed equal to one-half the design weight of the airplane.

(c) *Hull shear and bending loads.* The hull shear and bending loads shall be determined by proper consideration of the inertia loads which resist the linear and angular accelerations involved. To avoid excessive local shear loads, the water reaction may be distributed over the hull bottom, using pressures not less than those specified in § 3.268.

§ 3.271 *Stern loading condition*—(a) *Application of load.* The resultant water load shall be applied vertically in the plane of symmetry and shall be distributed over the hull bottom from the second step forward with an intensity equal to the pressures specified in §§ 3.267–3.272.

(b) *Magnitude of load.* The limit resultant load shall equal three-fourths of the maximum design weight of the airplane.

(c) *Hull shear and bending loads.* The hull shear and bending loads shall be determined by assuming the hull structure to be supported at the wing attachment fittings and neglecting internal inertia loads. This condition need not be applied to the fittings or to the portion of the hull ahead of the rear attachment fittings.

§ 3.272 *Side loading condition*—(a) *Application of load.* The resultant water load shall be applied in a vertical plane through the center of gravity. The vertical component shall be assumed to act in the plane of symmetry and horizontal component at a point halfway between the bottom of the keel and the load water line at design weight (at rest).

(b) *Magnitude of load.* The limit vertical component of acceleration shall be 3.25 and the side component shall be equal to 15 percent of the vertical component.

(c) *Hull shear and bending loads.* The hull shear and bending loads shall be determined by proper consideration of the inertia loads or by introducing couples at the wing attachment points. To avoid excessive local shear loads, the water reaction may be distributed over the hull bottom, using pressures not less than those specified by § 3.268.

FLOAT SEAPLANES

§ 3.273 *Landing with inclined reactions.* (a) The vertical component of the limit load factor shall be 4.2 except that it need not exceed a value given by the following formula:

$$n=3.0+0.133\ W/S$$

(b) The propeller axis (or equivalent reference line) shall be assumed to be horizontal and the resultant water reaction to be acting in the plane of symmetry and passing through the center of gravity of the airplane, but inclined so that its horizontal component is equal to one-fourth of its vertical component. Inertia forces shall be assumed to act in a direction parallel to the water reaction.

(c) *Factors of safety.* For the design of float attachment members, including the members necessary to complete a rigid brace truss through the fuselage, the factor of safety shall be 1.85. For the remaining structural members, the factor of safety shall be 1.5.

§ 3.275 *Landing with vertical reactions.* (a) The limit load factor shall be 4.33 acting vertically, except that it need not exceed a value given by the following formula:

$$n=3.0+0.133\ W/S$$

(b) The propeller axis (or equivalent reference line) shall be assumed to be horizontal, and the resultant water reaction to be vertical and passing through the center of gravity of the airplane.

(c) *Factors of safety.* The factors of safety shall be the same as those specified in § 3.273 (c).

§ 3.277 *Landing with side load.* The vertical component of the limit load factor shall be 4.0. The propeller axis (or equivalent reference line) shall be assumed to be horizontal and the resultant water reaction shall be assumed to be in the vertical plane which passes through the center of gravity of the airplane and is perpendicular to the propeller axis. The vertical load shall be applied through the keel or keels of the float or floats and evenly divided between the floats when twin floats are used. A side load equal to one-fourth of the vertical load shall be applied along a line approximately halfway between the bottom of the keel and the level of the water line at rest. When twin floats are used, the entire side load specified shall be applied to the float on the side from which the water reaction originates.

§ 3.278 *Supplementary load conditions.* Each main float of a float seaplane shall be capable of carrying the following loads when supported at the attachment fittings as installed on the airplane:

(a) A limit load, acting upward, applied at the bow end of float and of magnitude equal to that portion of the airplane weight normally supported by the particular float.

(b) A limit load, acting upward, applied at the stern of magnitude equal to 0.8 times that portion of the airplane weight normally supported by the particular float.

(c) A limit load, acting upward, applied at the step and of magnitude equal to 1.5 times that portion of the airplane weight normally supported by the particular float.

§ 3.279 *Bottom loads.* (a) Main seaplane float bottoms shall be designed to withstand the following local pressures:

(1) A limit pressure of at least 10 pounds per square inch over that portion of the bottom lying between the first step and a section 25 percent of the distance from the step to the bow.

(2) A limit pressure of at least 5 pounds per square inch over that portion of the bottom lying between the section 25 percent of the distance from the step to the bow and a section 75 percent of the distance from the step to the bow.

(3) A limit pressure of at least 3 pounds per square inch over that portion of the bottom aft of the step (aft of main step if more than one step is used).

(b) The local pressures determined in paragraph (a) (1), (2) and (3) of this section shall be applied over local areas in such a manner as to cause the maximum loads in local structure such as bottom plating and stringers.

(c) For the purpose of designing frames, keels, and chine structure, distributed bottom pressures equal to one-half of the local values specified above shall be applied over the entire specified bottom areas.

WING-TIP FLOAT AND SEA WING LOADS

§ 3.280 *Wing-tip float loads.* Wing-tip floats and their attachment, including the wing structure, shall be analyzed for each of the following conditions:

(a) A limit load acting vertically up at the completely submerged center of buoyancy and equal to 3 times the completely submerged displacement.

(b) A limit load inclined upward at 45 degrees to the rear and acting through the completely submerged center of buoyancy and equal to 3 times the completely submerged displacement.

(c) A limit load acting parallel to the water surface (laterally) applied at the center of area of the side view and equal to 1.5 times the completely submerged displacement.

§ 3.281 *Wing structure.* The primary wing structure shall incorporate sufficient extra strength to insure that failure of wing-tip float attachment members occurs before the wing structure is damaged.

§ 3.282 *Sea wing loads.* Sea wing design loads shall be based on suitable test data.

SUBPART D—DESIGN AND CONSTRUCTION

GENERAL

§ 3.291 *General.* The suitability of all questionable design details or parts having an important bearing on safety in operation shall be established by tests.

§ 3.292 *Materials and workmanship.* The suitability and durability of all materials used in the airplane structure shall be established on the basis of experience or tests. All materials used in the airplane structure shall conform to approved specifications which will insure their having the strength and other properties assumed in the design data. All workmanship shall be of a high standard.

§ 3.293 *Fabrication methods.* The methods of fabrication employed in constructing the airplane structure shall be such as to produce consistently sound structure. When a fabrication process such as gluing, spot welding, or heat-treating requires close control to attain this objective, the process shall be performed in accordance with an approved process specification.

§ 3.294 *Standard fastenings.* All bolts, pins, screws, and rivets used in the structure shall be of an approved type. The use of an approved locking device or method is required for all such bolts, pins, and screws. Self-locking nuts shall not be used on bolts subject to rotation during the operation of the airplane.

§ 3.295 *Protection.* 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. In seaplanes, special precaution shall be taken against corrosion from salt water, particularly where parts made from different metals are in close proximity. Adequate provisions for ventilation and drainage of all parts of the structure shall be made.

§ 3.296 *Inspection provisions.* Adequate means shall be provided to permit the close examination of such parts of the airplane as require periodic inspection, adjustments for proper alignment and functioning, and lubrication of moving parts.

STRUCTURAL PARTS

§ 3.301 *Material strength properties and design values.* 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. The design values shall be so chosen that the probability of any structure being under-strength because of material variations is extremely remote. Values contained in ANC-5 and ANC-18 shall be used unless shown to be inapplicable in a particular case.

NOTE: ANC-5, "Strength of Aircraft Elements" and ANC-18, "Design of Wood Aircraft Structures" are published by the Army-Navy-Civil Committee on Aircraft Design Criteria and may be obtained from the Government Printing Office, Washington 25, D. C.

§ 3.301-1 *Design properties (CAA policies which apply to § 3.301).* (a) With reference to section 5.00 of ANC-5, Amendment No. 1, allowable design property columns headed "Army-Navy" represent design properties which will be equalled or exceeded by the properties possessed by approximately 90 percent of the material. All other allowable design property columns relate to the minimum guaranteed properties and are based on values given in the various material specifications. The Administrator will permit uses of these design properties as outlined in subparagraphs (1) and (2) of this section, based on the objectives of § 3.301.

(1) In the case of structures where the applied loads are eventually distributed through single members 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 listed in ANC-5 shall be used.

NOTE: Typical examples of such items are:
1. Wing lift struts.
2. Spars in two-spar wings.
3. Sparcaps in regions such as wing cut-outs and wing center sections where loads are transmitted through caps only.
4. Primary attachment fittings dependent on single bolts for load transfer.

(2) Redundant structures wherein partial 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" allowable.

NOTE: Typical examples of such items are:
1. Sheet-stiffener combinations.
2. Multi-rivet or multiple bolt connections.

(b) Certain manufacturers have indicated a desire to use design value greater than the guaranteed minimums even in applications where only guaranteed minimum values would be permitted under paragraph (a) of this section, and have advocated that such allowables be based on "premium selection" of the material. Such increased design allowables will be acceptable to the Administrator: *Provided,* That a specimen or specimens of each individual item are tested prior to its use, to determine that the actual strength properties of that particular item will equal or exceed the properties used in design. This, in effect, results in the airplane or materials manufacturer guaranteeing higher minimum properties than those given in the basic procurement specifications.

(c) When strength testing is employed to establish design allowables (such as in the case of sheet-stiffener compression tests), the test results shall be reduced to values which would be met by material having the design allowable material properties for the part under consideration, as covered in subparagraphs (1) and (2) of this section.

NOTE: Sections 1.543 and 1.544 of ANC-5 outline two means of accomplishing this, but are by no means considered as the only methods available.

[12 F. R. 3436. Correction noted at 14 F. R. 36]

§ 3.302 *Special factors.* Where there may be uncertainty concerning the actual strength of particular parts of the structure or where the strength is likely to deteriorate in service prior to normal replacement, increased factors of safety shall be provided to insure that the reliability of such parts is not less than the rest of the structure as specified in §§ 3.303-3.306.

§ 3.303 *Variability factor.* For parts whose strength is subject to appreciable variability due to uncertainties in manufacturing processes and inspection methods, the factor of safety shall be increased sufficiently to make the probability of any part being under-strength from this cause extremely remote. Minimum variability factors (only the highest pertinent variability factor need be considered) are set forth in §§ 3.304-3.306.

§ 3.304 *Castings.* (a) Where visual inspection only is to be employed, the variability factor shall be 2.0.

(b) The variability factor may be reduced to 1.25 for ultimate loads and

1.15 for limit loads when at least three sample castings are tested to show compliance with these factors, and all sample and production castings are visually and radiographically inspected in accordance with an approved inspection specification.

(c) Other inspection procedures and variability factors may be used if found satisfactory by the Administrator.

§ 3.304-1 *Casting factors (CAA policies which apply to § 3.304)*. With reference to paragraphs (b) and (c) of § 3.304, the Administrator has approved specific proposals which permit the use of lower casting factors as specified in (b), with 100 percent radiographic inspection on initial runs, but with radiographic inspection gradually reduced on production lots as it becomes evident that adequate quality control has been established. All such procedures require the submittal and execution of a satisfactory process specification and statistical proof that adequate quality control has been achieved.

[12 F. R. 3437. Correction noted at 14 F. R. 36]

§ 3.305 *Bearing factors.* (a) The factor of safety in bearing at bolted or pinned joints shall be suitably increased to provide for the following conditions:

(1) Relative motion in operation (control surface and system joints are covered in §§ 3.327-3.347).

(2) Joints with clearance (free fit) subject to pounding or vibration.

(b) Bearing factors need not be applied when covered by other special factors.

§ 3.306 *Fitting factor.* Fittings are defined as parts such as end terminals used to join one structural member to another. A multiplying factor of safety of at least 1.15 shall be used in the analysis of all fittings the strength of which is not proved by limit and ultimate load tests in which the actual stress conditions are simulated in the fitting and the surrounding structure. This factor applies to all portions of the fitting, the means of attachment, and bearing on the members joined. In the case of integral fittings, the part shall be treated as a fitting up to the point where the section properties become typical of the member. The fitting factor need not be applied where a type of joint design based on comprehensive test data is used. The following are examples: continuous joints in metal plating, welded joints, and scarf joints in wood, all made in accordance with approved practices.

§ 3.307 *Fatigue strength.* The structure shall be designed, insofar as practicable, to avoid points of stress concentration where variable stresses above the fatigue limit are likely to occur in normal service.

FLUTTER AND VIBRATION

§ 3.311 *Flutter and vibration prevention measures.* Wings, tail, and control surfaces shall be free from flutter, airfoil divergence, and control reversal from lack of rigidity, for all conditions of operation within the limit *V-n* envelope, and the following detail requirements shall apply:

(a) Adequate wing torsional rigidity shall be demonstrated by tests or other methods found suitable by the Administrator.

(b) The mass balance of surfaces shall be such as to preclude flutter.

(c) The natural frequencies of all main structural components shall be determined by vibration tests or other methods found satisfactory by the Administrator.

WINGS

§ 3.317 *Proof of strength.* The strength of stressed-skin wings shall be substantiated by load tests or by combined structural analysis and tests.

§ 3.318 *Ribs.* (a) The strength of ribs in other than stressed-skin wings shall be proved by test to at least 125 percent of the ultimate loads for the most severe loading conditions, unless a rational load analysis and test procedure is employed and the tests cover the variability of the particular type of construction.

(b) The effects of ailerons and high lift devices shall be properly accounted for. Rib tests shall simulate conditions in the airplane with respect to torsional rigidity of spars, fixity conditions, lateral support, and attachment to spars.

§ 3.318-1 *Rib tests (CAA policies which apply to § 3.318)*. Section 3.318 was drafted so as to allow the proof of strength of ribs in stressed skin wings to be made as part of 100-percent ultimate load test of the wings, in cases where the complete wing is tested in such a manner as to simulate the actual air load distribution. In such cases the Administrator will not require that separate rib tests be made. When ribs of stressed skin wings are tested separately from the wing and a rational load distribution is made, a suitable variability factor (see § 3.303) shall be employed in determining the test loads. Although no specific value is stated in § 3.303, a factor of 1.15 is considered acceptable. However, consideration may be given to a lower factor if such lower factor were substantiated by tests on a large number of ribs.

[12 F. R. 3437. Correction noted at 14 F. R. 36]

§ 3.319 *External bracing.* When wires are used for external lift bracing they shall be double unless the design provides for a lift-wire-cut condition. Rigging loads shall be taken into account in a rational or conservative manner. The end connections of brace wires shall be such as to minimize restraint against bending or vibration. When brace struts of large fineness ratio are used, the aerodynamic forces on such struts shall be taken into account.

§ 3.320 *Covering.* Strength tests of fabric covering shall be required unless approved grades of cloth, methods of support, attachment, and finishing are employed. Special tests shall be required when it appears necessary to account for the effects of unusually high design air speeds, slipstream velocities, or other unusual conditions.

§ 3.320-1 *Aircraft fabric (CAA rules which apply to § 3.320)*. See §§ 4b.302-1 and 4b.302-2 of this chapter.

[13 F. R. 7723]

CONTROL SURFACES (FIXED AND MOVABLE)

§ 3.327 *Proof of strength.* Limit load tests of control surfaces are required. Such tests shall include the horn or fitting to which the control system is attached. In structural analyses, rigging loads due to wire bracing shall be taken into account in a rational or conservative manner.

§ 3.328 *Installation.* Movable tail surfaces shall be so installed that there is no interference between the surfaces or their bracing when each is held in its extreme position and all others are operated through their full angular movement. When an adjustable stabilizer is used, stops shall be provided which, in the event of failure of the adjusting mechanism, will limit its travel to a range permitting safe flight and landing.

§ 3.329 *Hinges.* Control surface hinges, excepting ball and roller bearings, shall incorporate a multiplying factor of safety of not less than 6.67 with respect to the ultimate bearing strength of the softest material used as a bearing. For hinges incorporating ball or roller bearings, the approved rating of the bearing shall not be exceeded. Hinges shall provide sufficient strength and rigidity for loads parallel to the hinge line.

CONTROL SYSTEMS

§ 3.335 *General.* All controls shall operate with sufficient ease, smoothness, and positiveness to permit the proper performance of their function and shall be so arranged and identified as to provide convenience in operation and prevent the possibility of confusion and subsequent inadvertent operation. (See § 3.384 for cockpit controls.)

§ 3.336 *Primary flight controls.* (a) Primary flight controls are defined as those used by the pilot for the immediate control of the pitching, rolling, and yawing of the airplane.

(b) For two-control airplanes the design shall be such as to minimize the likelihood of complete loss of the lateral directional control in the event of failure of any connecting or transmitting element in the control system.

§ 3.337 *Trimming controls.* Proper precautions shall be taken against the possibility of inadvertent, improper, or abrupt tab operations. Means shall be provided to indicate to the pilot the direction of control movement relative to airplane motion and the position of the trim device with respect to the range of adjustment. The means used to indicate the direction of the control movement shall be adjacent to the control, and the means used to indicate the position of the trim device shall be easily visible to the pilot and so located and operated as to preclude the possibility of confusion. Trimming devices shall be capable of continued normal operation notwithstanding the failure of any one connecting or transmitting element in the primary flight control system. Tab controls shall be irreversible unless the tab is properly balanced and possesses no unsafe flutter characteristics. Irreversible tab systems shall provide adequate rigidity and reliability in the portion of the system from the tab to the attachment of the irreversible unit to the airplane structure.

§ 3.338 *Wing flap controls.* The controls shall be such that when the flap has been placed in any position upon which compliance with the performance requirements is based, the flap will not move from that position except upon further adjustment of the control or the automatic operation of a flap load limiting device. Means shall be provided to indicate the flap position to the pilot. If any flap position other than fully retracted or extended is used to show compliance with the performance requirements, such means shall indicate each such position. The rate of movement of the flaps in response to the operation of the pilot's control, or of an automatic device shall not be such as to result in unsatisfactory flight or performance characteristics under steady or changing conditions of air speed, engine power, and airplane attitude. (See § 3.109 (b) and (c).)

§ 3.339 *Flap interconnection.* (a) The motion of flaps on opposite sides of the plane of symmetry shall be synchronized by a mechanical interconnection, unless the airplane is demonstrated to have safe flight characteristics while the flaps are retracted on one side and extended on the other.

(b) Where an interconnection is used, in the case of multiengine airplanes, it shall be designed to account for the unsymmetrical loads resulting from flight with the engines on one side of the plane of symmetry inoperative and the remaining engines at take-off power. For single-engine airplanes, it may be assumed that 100 percent of the critical air load acts on one side and 70 percent on the other.

§ 3.340 *Stops.* All control systems shall be provided with stops which positively limit the range of motion of the control surfaces. Stops shall be so located in the system that wear, slackness, or take-up adjustments will not appreciably affect the range of surface travel. Stops shall be capable of withstanding the loads corresponding to the design conditions for the control system.

§ 3.341 *Control system locks.* When a device is provided for locking a control surface while the airplane is on the ground or water:

(a) The locking device shall be so installed as to provide unmistakable warning to the pilot when it is engaged, and

(b) Means shall be provided to preclude the possibility of the lock becoming engaged during flight.

§ 3.342 *Proof of strength.* Tests shall be conducted to prove compliance with limit load requirements. The direction of test loads shall be such as to produce the most severe loading of the control system structure. The tests shall include all fittings, pulleys, and brackets used to attach the control system to the primary structure. Analyses or individual load tests shall be conducted to demonstrate compliance with the multiplying factor of safety requirements specified for control system joints subjected to angular motion.

§ 3.343 *Operation test.* An operation test shall be conducted by operating the controls from the pilot compartment with the entire system so loaded as to correspond to the limit air loads on the surface. In this test there shall be no jamming, excessive friction, or excessive deflection.

CONTROL SYSTEM DETAILS

§ 3.344 *General.* All control systems and operating devices shall be so designed and installed as to prevent jamming, chafing, or interference as a result of inadequate clearances or from cargo, passengers, or loose objects. Special precautions shall be provided in the cockpit to prevent the entry of foreign objects into places where they might jam the controls. Provisions shall be made to prevent the slapping of cables or tubes against parts of the airplane.

§ 3.345 *Cable systems.* Cables, cable fittings, turnbuckles, splices, and pulleys shall be in accordance with approved specifications. Cables smaller than ⅛-inch diameter shall not be used in primary control systems. The design of cable systems shall be such that there will not be hazardous change in cable tension throughout the range of travel under operating conditions and temperature variations. Pulley types and sizes shall correspond to the cables with which they are used, as specified on the pulley specification. All pulleys shall be provided with satisfactory guards which shall be closely fitted to prevent the cables becoming misplaced or fouling, even when slack. The pulleys shall lie in the plane passing through the cable within such limits that the cable does not rub against the pulley flange. Fairleads shall be so installed that they are not required to cause a change in cable direction of more than 3 degrees. Clevis pins (excluding those not subject to load or motion) retained only by cotter pins shall not be employed in the control system. Turnbuckles shall be attached to parts having angular motion in such a manner as to prevent positively binding throughout the range of travel. Provisions for visual inspection shall be made at all fairleads, pulleys, terminals, and turnbuckles.

§ 3.345–1 *Cables in primary control systems (CAA interpretations which apply to § 3.345).* Section 3.345 provides that "cables smaller than ⅛-inch diameter shall not be used in primary control systems." Primary control systems are normally considered to be the aileron, rudder, and elevator control systems. Hence this minimum of ⅛ inch need not be applied to tab control cables having high strength margins. However, in cases where the airplane would not be safely controllable in flight and landing with tabs in the most adverse positions required for the various critical trim, weight, and center of gravity conditions, the Administrator will require that tab systems be so designed as to provide reliability equivalent to that required for primary systems. Examples are pulley sizes, guards, use of fairleads, inspection provisions, etc.

[12 F. R. 3437. Correction noted at 14 F. R. 36]

§ 3.346 *Joints.* Control system joints subject to angular motion in push-pull systems, excepting ball and roller bearing systems, shall incorporate a multiplying factor of safety of not less than 3.33 with respect to the ultimate bearing strength of the softest material used as a bearing. This factor may be reduced to 2.0 for such joints in cable control systems. For ball or roller bearings the approved rating of the bearing shall not be exceeded.

§ 3.347 *Spring devices.* The reliability of any spring devices used in the control system shall be established by tests simulating service conditions, unless it is demonstrated that failure of the spring will not cause flutter or unsafe flight characteristics.

LANDING GEAR

SHOCK ABSORBERS

§ 3.351 *Tests.* Shock absorbing elements in main, nose, and tail wheel units shall be substantiated by the tests specified in the following section. In addition, the shock absorbing ability of the landing gear in taxying must be demonstrated in the operational tests of § 3.146.

§ 3.352 *Shock absorption tests.* (a) It shall be demonstrated by energy absorption tests that the limit load factors selected for design in accordance with § 3.243 will not be exceeded in landings with the limit descent velocity specified in that section.

(b) In addition, a reserve of energy absorption shall be demonstrated by a test in which the descent velocity is at least 1.2 times the limit descent velocity. In this test there shall be no failure of the shock absorbing unit, although yielding of the unit will be permitted. Wing lift equal to the weight of the airplane may be assumed for purposes of this test.

§ 3.352–1 *Landing gear drop tests (CAA policies which apply to § 3.352).* (a) The following method has been approved by the Administrator for determining the effective mass to be dropped in drop tests of nose wheel landing gear assemblies pursuant to § 3.352 (a): For aircraft with nose wheel type gear, the effective mass to be used in free drop test of the nose wheel shall be determined from the formula for W_e (§§ 3.353 and 3.355) using $W=W_n$ where W_n is equal to the vertical components of the resultant force acting on the nose wheel, computed under the following assumptions: (1) the mass of the airplane concentrated at the center of gravity and exerting a force of 1.0 g downward and 0.33 g forward, (2) the nose and the main gears and tires in static position, and (3) the resultant reactions at the main and nose gears acting through the axles and parallel to the resultant force at the airplane center of gravity.

NOTE: By way of explanation, the use of an inclined reactions condition as the basis for determining the mass to be dropped with a nose wheel unit is based on rational dynamic investigation of the landing condition, assuming the landing is made with simultaneous three-point contact, zero pitching velocity, and a drag component representing the average wheel spin-up reactions during the landing impact. Although spin-up loads on small airplanes may be less than the value implied by the formula, such airplanes are more likely to be landed with a nosing down pitching velocity, or in soft ground. The vertical component of the ground reaction is specified above because the method of defining the direction of the inertia force at the center of gravity gives a resultant effective mass greater than that of the airplane.

(b) The following procedure has been approved by the Administrator for determining the attitude in which the landing gear unit should be dropped pursuant to § 3.352 (a): The attitude in which a landing gear unit is dropped shall be that which simulates the airplane landing condition which is critical from the standpoint of energy to be absorbed by the particular unit, thus: (1) For nose wheel type landing gear, the nose wheel gear shall be drop tested in an attitude which simulates the three point landing inclined reaction condition; (2) the attitude selected for main gear drop tests shall be that which simulates the two-wheel level landing with inclined reactions condition.

NOTE: In addition, it is recommended that the main gear be dropped in an attitude simulating the tail-down landing with vertical reactions condition if the geometry of the gear is such that this condition is likely to result in shock strut action appreciably different from that obtained in level attitude drop tests; for example, when a cantilever shock strut has a large inclination with respect to the direction of the ground reaction.

(3) Tail wheel units shall be tested in such a manner as to simulate the tail-down landing condition (three-point contact). Drag components may be covered separately by the tail wheel "obstruction" condition.

(c) The Administrator has accepted the following procedure for determining slopes of inclined platforms when such are used in drop tests: When the arbitrary drag components given on Fig. 3-12 (a) of this part are used for the design of the landing gear in the level landing conditions, the drag loads in the drop tests for these conditions may be simulated by dropping the units onto inclined platforms so arranged as to obtain the proper direction of the resultant ground reactions in relation to the landing gear. (If wheel spin-up loads for these conditions are determined by rational methods and found to be more severe than the arbitrary drag loads, it is suggested that the spin-up loads be simulated by dropping the gear onto a level platform with wheels spinning.) In at least one limit drop test the platform should simulate the friction characteristics of paved runways and the rotational speed of the wheel just prior to contact should correspond to an airplane ground speed of 1.2 V_{s_0}. It is suggested that additional limit drops be made onto surfaces of lower friction coefficient and at several wheel rotational speeds; coefficients for example, corresponding to 0.6, 0.8 and 1.0 V_{s_0}.) The direction of wheel rotation in the drop test should be opposite to that which would occur in landing the airplane. Spin-up loads which are slightly greater than the arbitrary drag loads can probably be simulated satisfactorily by inclined platforms, but platforms having greater inclinations may not simulate spin-up loads correctly and are not recommended.

[12 F. R. 3437. Correction noted at 14 F. R. 36]

§ 3.353 *Limit drop tests.* (a) If compliance with the specified limit landing conditions of § 3.352 (a) is demonstrated by free drop tests, these shall be conducted on the complete airplane, or on units consisting of wheel, tire, and shock absorber in their proper relation, from free drop heights not less than the following:

$$h \text{ (inches)} = 3.6\ (W/S)^{0.5}$$

except that the free drop height shall not be less than 9.2 inches and need not be greater than 18.7 inches.

(b) In simulating the permissible wing lift in free drop tests, the landing gear unit shall be dropped with an effective mass equal to:

$$W_e = W\left[\frac{h+(1-L)\ d}{h+d}\right]$$

where

W_e = the effective weight to be used in the drop test.

h = specified height of drop in inches.

d = deflection under impact of the tire (at the approved inflation pressure) plus the vertical component of the axle travel relative to the drop mass. The value of d used in the computation of W_e shall not exceed the value actually obtained in the drop tests.

$W = W_M$ for main gear units, and shall be equal to the static weight on the particular unit with the airplane in the level attitude (with the nose wheel clear, in the case of nose wheel type airplanes).

$W = W_T$ for tail gear units, and shall be equal to the static weight on the tail unit with the airplane in the tail down attitude.

$W = W_N$ for nose wheel units, and shall be equal to the static reaction which will exist at the nose wheel when the mass of the airplane is concentrated at the center of gravity and exerts a force of 1.0g downward and 0.33g forward.

L = ratio of assumed wing lift to airplane weight, not greater than 0.667.

The attitude in which the landing gear unit is drop tested shall be such as to simulate the airplane landing condition which is critical from the standpoint of energy to be absorbed by the particular unit.

§ 3.354 *Limit load factor determination.* In determining the limit airplane inertia load factor n from the free drop test described above, the following formula shall be used:

$$n = n_j \frac{W_e}{W} + L$$

where

n_j = the load factor developed in the drop test, i. e., the acceleration (d_v/dt) in g's recorded in the drop test, plus 1.0.

The value of n so determined shall not be greater than the limit inertia load factor used in the landing conditions, § 3.243.

§ 3.355 *Reserve energy absorption drop tests.* If compliance with the reserve energy absorption condition specified in § 3.352 (b) is demonstrated by free drop tests, the drop height shall be not less than 1.44 times the drop height specified in § 3.353. In simulating wing lift equal to the airplane weight, the units shall be dropped with an effective mass equal to

$$W_e = W\frac{h}{h+d}$$

where the symbols and other details are the same as in § 3.353.

RETRACTING MECHANISM

§ 3.356 *General.* The landing gear retracting mechanism and supporting structure shall be designed for the maximum load factors in the flight conditions when the gear is in the retracted position. It shall also be designed for the combination of friction, inertia, brake torque, and air loads occurring during retraction at any air speed up to 1.6V_{s_1}, flaps retracted and any load factors up to those specified for the flaps extended condition, § 3.190. The landing gear and retracting mechanism, including the wheel well doors, shall withstand flight loads with the landing gear extended at any speed up to at least 1.6 V_{s_1} flaps retracted. Positive means shall be provided for the purpose of maintaining the wheels in the extended position.

§ 3.357 *Emergency operation.* When other than manual power for the operation of the landing gear is employed, an auxiliary means of extending the landing gear shall be provided.

§ 3.358 *Operation test.* Proper functioning of the landing gear retracting mechanism shall be demonstrated by operation tests.

§ 3.359 *Position indicator and warning device.* When retractable landing wheels are used, means shall be provided for indicating to the pilot when the wheels are secured in the extreme positions. In addition, landplanes shall be provided with an aural or equally effective warning device which shall function continuously after the throttle is closed until the gear is down and locked.

§ 3.359-1 *Wheel position indicators (CAA policies which apply to § 3.359).* The "means" required by § 3.359 may consist of lights of various colors. The signal "all lights out" will be considered by the Administrator as satisfactory if used to indicate intermediate gear positions but it will not be considered as providing adequate safety if used to indicate either extreme gear locked position.

[12 F. R. 3437. Correction noted at 14 F. R. 36]

§ 3.360 *Control.* See § 3.384.

WHEELS AND TIRES

§ 3.361 *Wheels.* (a) Main landing gear wheels (i. e., those nearest the airplane center of gravity) shall be of an approved type.

(b) The rated static load of each main wheel shall not be less than the design weight for ground loads (§ 3.242) divided by the number of main wheels.

Nose wheels shall have been tested for an ultimate radial load not less than the maximum nose wheel ultimate load obtained in the ground loads requirements, and for corresponding side and burst loads.

§ 3.362 *Tires.* A landing gear wheel may be equipped with any make or type of tire, provided that the tire is a proper fit on the rim of the wheel and provided that the approved tire rating is not exceeded under the following conditions:

(a) Load on main wheel tires equal to the airplane weight divided by the number of wheels,

(b) Load on nose wheel tires (to be compared with the dynamic rating established for such tires) equal to the reaction obtained at the nose wheel, assuming the mass of the airplane concentrated at the center of gravity and exerting a force of $1.0g$ downward and $0.31g$ forward, the reactions being distributed to the nose and main wheels by the principle of statics with the drag reaction at the ground applied only at those wheels having brakes. When specially constructed tires are used to support an airplane, the wheels shall be plainly and conspicuously marked to that effect. Such markings shall include the make, size, number of plies, and identification marking of the proper tire.

NOTE: Approved ratings are those assigned by the Tire and Rim Association or by the Administrator.

BRAKES

§ 3.363 *Brakes.* Brakes shall be installed which are adequate to prevent the airplane from rolling on a paved runway while applying take-off power to the critical engine, and of sufficient capacity to provide adequate speed control during taxying without the use of excessive pedal or hand forces.

SKIS

§ 3.364 *Skis.* Skis shall be of an approved type. The approved rating of the skis shall not be less than the maximum weight of the airplane on which they are installed.

§ 3.365 *Installation.* (a) When type certificated skis are installed, the installation shall be made in accordance with the ski or airplane manufacturer's recommendations which shall have been approved by the Administrator. When other than type certificated skis are installed, data shall be submitted to the Administrator showing a dimensional drawing of the proposed method of attaching the skis, the sizes and material of the restraining members and attachment fittings.

(b) In addition to such shock cord(s) as may be provided, front and rear check cables shall be used on skis not equipped with special stabilizing devices.

§ 3.366 *Tests.* (a) If the airplane is of a model not previously approved with the specific ski installation, it shall satisfactorily pass a ground inspection of the installation, demonstrate satisfactory landing and taxying characteristics, and comply with such flight tests as are found necessary to indicate that the airplane's flight characteristics are satisfactory with the skis installed.

(b) If the airplane is of a model previously approved with the specific ski installation, it need pass satisfactorily only a ground inspection of the installation.

HULLS AND FLOATS

§ 3.371 *Buoyancy (main seaplane floats).* (a) Main seaplane floats shall have a buoyancy in excess of that required to support the maximum weight of the airplane in fresh water as follows:

(1) 80 percent in the case of single floats.

(2) 90 percent in the case of double floats.

(b) Main seaplane floats for use on airplanes of 2,500 pounds or more maximum weight shall contain at least 5 watertight compartments of approximately equal volume. Main seaplane floats for use on airplanes of less than 2,500 pounds maximum weight shall contain at least four such compartments.

§ 3.372 *Buoyancy (boat seaplanes).* The hulls of boat seaplanes and amphibians shall be divided into watertight compartments in accordance with the following requirements:

(a) In airplanes of 5,000 pounds or more maximum weight, the compartments shall be so arranged that, with any two adjacent compartments flooded, the hull and auxiliary floats (and tires, if used) will retain sufficient buoyancy to support the maximum weight of the airplane in fresh water.

(b) In airplanes of 1,500 to 5,000 pounds maximum weight, the compartments shall be so arranged that, with any one compartment flooded, the hull and auxiliary floats (and tires, if used) will retain sufficient buoyancy to support the maximum weight of the airplane in fresh water.

(c) In airplanes of less than 1,500 pounds maximum weight, watertight subdivision of the hull is not required.

(d) Bulkheads may have watertight doors for the purpose of communication between compartments.

§ 3.373 *Water stability.* Auxiliary floats shall be so arranged that when completely submerged in fresh water, they will provide a righting moment which is at least 1.5 times the upsetting moment caused by the airplane being tilted. A greater degree of stability may be required by the Administrator in the case of large flying boats, depending on the height of the center of gravity above the water level, the area and location of wings and tail surfaces, and other considerations.

FUSELAGE

PILOT COMPARTMENT

§ 3.381 *General.* (a) The arrangement of the pilot compartment and its appurtenances shall provide a satisfactory degree of safety and assurance that the pilot will be able to perform all his duties and operate the controls in the correct manner without unreasonable concentration and fatigue.

(b) The primary flight control units listed on Figure 3–14, excluding cables and control rods, shall be so located with respect to the propellers that no portion of the pilot or controls lies in the region between the plane of rotation of any inboard propeller and the surface generated by a line passing through the center of the propeller hub and making an angle of 5° forward or aft of the plane of rotation of the propeller.

§ 3.382 *Vision.* The pilot compartment shall be arranged to afford the pilot a sufficiently extensive, clear, and undistorted view for the safe operation of the airplane. During flight in a moderate rain condition, the pilot shall have an adequate view of the flight path in normal flight and landing, and have sufficient protection from the elements so that his vision is not unduly impaired. This may be accomplished by providing an openable window or by a means for maintaining a portion of the windshield in a clear condition without continuous attention by the pilot. The pilot compartment shall be free of glare and reflections which would interfere with the pilot's vision. For airplanes intended for night operation, the demonstration of these qualities shall include night flight tests.

§ 3.383 *Pilot windshield and windows.* All glass panes shall be of a nonsplintering safety type.

§ 3.384 *Cockpit controls.* (a) All cockpit controls shall be so located and, except for those the function of which is obvious, identified as to provide convenience in operation including provisions to prevent the possibility of confusion and consequent inadvertent operation. (See Fig. 3–14 for required sense of motion of cockpit controls.) The controls shall be so located and arranged that when seated it will be readily possible for the pilot to obtain full and unrestricted movement of each control without interference from either his clothing or the cockpit structure.

(b) Identical power-plant controls for the several engines in the case of multiengine airplanes shall be so located as to prevent any misleading impression as to the engines to which they relate.

Controls	*Movement and actuation*
Primary:	
Aileron	Right (clockwise) for right wing down.
Elevator	Rearward for nose up.
Rudder	Right pedal forward for nose right.
Power plant:	
Throttle	Forward to open.

FIGURE 3–14 COCKPIT CONTROLS

§ 3.385 *Instruments and markings.* See § 3.661 relative to instrument arrangement. The operational markings, instructions, and placards required for the instruments and controls are specified in §§ 3.756 to 3.765.

EMERGENCY PROVISIONS

§ 3.386 *Protection.* The fuselage shall be designed to give reasonable assurance that each occupant, if he makes proper use of belts or harness for which provisions are made in the design, will not suffer serious injury during minor crash conditions as a result of contact of any vulnerable part of his body with any penetrating or relatively solid object, although it is accepted that parts of the airplane may be damaged.

(a) The ultimate accelerations to which occupants are assumed to be subjected shall be as follows:

	N, U	A
Upward	3.0g	4.5g
Forward	9.0g	9.0g
Sideward	1.5g	1.5g

(b) For airplanes having retractable landing gear, the fuselage in combination with other portions of the structure shall be designed to afford protection of the occupants in a wheels-up landing with moderate descent velocity.

(c) If the characteristics of an airplane are such as to make a turn-over reasonably probable, the fuselage of such an airplane in combination with other portions of the structure shall be designed to afford protection of the occupants in a complete turn-over.

NOTE: In § 3.386 (b) and (c), a vertical ultimate acceleration of 3g and a friction coefficient of 0.5 at the ground may be assumed.

§ 3.387 *Exits.* (a) Closed cabins on airplanes carrying more than 5 persons shall be provided with emergency exits consisting of movable windows or panels or of additional external doors which provide a clear and unobstructed opening, the minimum dimensions of which shall be such that a 19-by-26-inch ellipse may be completely inscribed therein. The exits shall be readily accessible, shall not require exceptional agility of a person using them, and shall be distributed so as to facilitate egress without crowding in all probable attitudes resulting from a crash. The method of opening shall be simple and obvious, and the exits shall be so arranged and marked as to be readily located and operated even in darkness. Reasonable provisions shall be made against the jamming of exits as a result of fuselage deformation. The proper functioning of exits shall be demonstrated by tests.

(b) The number of emergency exits required is as follows:

(1) Airplanes with a total seating capacity of more than 5 persons, but not in excess of 15, shall be provided with at least one emergency exit or one suitable door in addition to the main door specified in § 3.389. This emergency exit, or second door, shall be on the opposite side of the cabin from the main door.

(2) Airplanes with a seating capacity of more than 15 persons shall be provided with emergency exits or doors in addition to those required in paragraph (b) (1) of this section. There shall be one such additional exit or door located either in the top or side of the cabin for every additional 7 persons or fraction thereof above 15, except that not more than four exits, including doors, will be required if the arrangement and dimensions are suitable for quick evacuation of all occupants.

(c) If the pilot compartment is separated from the cabin by a door which is likely to block the escape in the event of a minor crash, it shall have its own exit, but such exit shall not be considered as an emergency exit for the passengers.

(d) In categories U and A exits shall be provided which will permit all occupants to bail out quickly with parachutes.

§ 3.388 *Fire precautions*—(a) *Cabin interiors.* Only materials which are flash-resistant shall be used. In compartments where smoking is to be permitted, the materials of the cabin lining, floors, upholstery, and furnishings shall be flame-resistant. Such compartments shall be equipped with an adequate number of self-contained ash trays. All other compartments shall be placarded against smoking.

(b) *Combustion heaters.* Gasoline operated combustion heater installations shall comply with applicable parts of the power-plant installation requirements covering fire hazards and precautions. All applicable requirements concerning fuel tanks, lines, and exhaust systems shall be considered.

§ 3.388–1 *Combustion heaters (CAA rules which apply to § 3.388 (b)).* See § 4b.445–1 of this chapter.

[Supp. 3, 14 F. R. 3305]

PERSONNEL AND CARGO ACCOMMODATIONS

§ 3.389 *Doors.* Closed cabins on all airplanes carrying passengers shall be provided with at least one adequate and easily accessible external door. No passenger door shall be so located with respect to the propeller discs as to endanger persons using the door.

§ 3.390 *Seats and berths*—(a) *Passenger seats and berths.* All seats and berths and supporting structure shall be designed for a passenger weight of 170 pounds (190 pounds with parachute for the acrobatic and utility categories) and the maximum load factors corresponding to all specified flight and ground load conditions including the emergency conditions of § 3.386.

(b) *Pilot seats.* Pilot seats shall be designed for the reactions resulting from the application of the pilot forces to the primary flight controls as specified in § 3.231.

(c) *Categories U and A.* All seats designed to be occupied in the U and A categories under § 3.74 (c) (4) shall be designed to accommodate passengers wearing parachutes.

§ 3.391 *Safety belt or harness provisions.* Provisions shall be made at all seats and berths for the installation of belts or harness of sufficient strength to comply with the emergency conditions of § 3.386.

§ 3.392 *Cargo compartments.* Each cargo compartment shall be designed for the placarded maximum weight of contents and critical load distributions at the appropriate maximum load factors corresponding to all specified flight and ground load conditions. Suitable provisions shall be made to prevent the contents of cargo compartments from becoming a hazard by shifting. Such provisions shall be adequate to protect the passengers from injury by the contents of any cargo compartment when the ultimate forward acting accelerating force is 4.5g.

§ 3.393 *Ventilation.* All passenger and crew compartments shall be suitably ventilated. Carbon monoxide concentration shall not exceed 1 part in 20,000 parts of air.

MISCELLANEOUS

§ 3.401 *Leveling marks.* Leveling marks shall be provided for leveling the airplane on the ground.

SUBPART E—POWER-PLANT INSTALLATIONS; RECIPROCATING ENGINES

GENERAL

§ 3.411 *Components.* (a) The power-plant installation shall be considered to include all components of the airplane which are necessary for its propulsion. It shall also be considered to include all components which affect the control of the major propulsive units or which affect their continued safety of operation.

(b) All components of the power-plant installation shall be constructed, arranged, and installed in a manner which will assure the continued safe operation of the airplane and power plant. Accessibility shall be provided to permit such inspection and maintenance as is necessary to assure continued airworthiness.

§ 3.411–1 *Reverse-thrust propellers (CAA policies which apply to § 3.411 (b)).* In applying § 3.411 (b), the Administrator will approve as providing adequate safety only those reverse-thrust propeller installations which conform in all details with the following standards:

(a) Exceptional pilot skill shall not be required in taxying or any condition in which reverse thrust is to be used.

(b) Recommended operating procedures and operating limitations and placards shall be established.

(c) Throttle movement shall be such that the motion is in the direction of the desired acceleration of the airplane.

(d) The airplane control characteristics shall be satisfactory with regard to control forces encountered, and buffeting shall not be such as to be likely to cause structural damage.

(e) The directional control shall be adequate using normal piloting skill.

(f) It shall be determined that no dangerous condition is encountered in the event of a sudden failure of one engine in any likely operating condition.

(g) The operating procedures and airplane configuration shall be such as to provide a reasonable safeguard against serious structural damage to parts of the airplane due to the reverse airflow.

(h) It shall be determined that the pilot's vision is not dangerously obscured under normal operating conditions on dusty or wet runways and where light snow is on the runway.

(i) It shall be impossible to place the propellers in the reverse-thrust position until the airplane is on the ground, unless it is demonstrated that it is safe to reverse the propellers in any likely flight condition. Consideration shall be given to possible rebound of the airplane following initial contact, at which point propeller reversal has taken place.

(j) The mechanism actuating the propeller and controlling the engine shall maintain sufficient power to keep the engine running at an adequate speed to prevent engine stalling during or after the propeller reversing operation.

(k) It shall not be possible under any likely condition to cause excessive overspeed of the propeller during the propeller reversing operation.

(l) The propeller control arrangement shall be such as to provide adequate safeguards against inadvertent reversal of propellers.

(m) The engine cooling characteristics shall be satisfactory when operated within the operating limitations.

(n) If it is desired to certificate reverse thrust for use in taxying only, it will be permissible to omit requirement of items (c) and (i), if the following are complied with: Deliberate action with intent to reverse the propellers is required, and placard in plain view of pilot must warn not to reverse the propellers in the air and to be used for taxying only.

[12 F. R. 3437. Correction noted at 14 F. R. 36]

ENGINES AND PROPELLERS

§ 3.415 *Engines.* Engines installed in certificated airplanes shall be of a type which has been certificated in accordance with the provisions of Part 13 of this chapter.

§ 3.416 *Propellers.* (a) Propellers installed in certificated airplanes shall be of a type which has been certificated in accordance with the provisions of Part 14 of this chapter.

(b) The maximum engine power and propeller shaft rotational speed permissible for use in the particular airplane involved shall not exceed the corresponding limits for which the propeller has been certificated.

§ 3.417 *Propeller vibration.* In the case of airplanes equipped with metal propellers, the magnitude of the propeller blade vibration stresses under all normal conditions of operation shall be determined by actual measurements or by comparison with similar installations for which such measurements have been made. The vibration stresses thus determined shall not exceed values which have been demonstrated to be safe for continuous operation. Vibration tests may be waived and the propeller installation accepted on the basis of service experience, engine or ground tests which show adequate margins of safety, or other considerations which satisfactorily substantiate its safety in this respect. In addition to metal propellers, the Administrator may require that similar substantiation of the vibration characteristics be accomplished for other types of propellers, with the exception of conventional fixed-pitch wood propellers.

§ 3.418 *Propeller pitch and speed limitations.* The propeller pitch and speed shall be limited to values which will assure safe operation under all normal conditions of operation and will assure compliance with the performance requirements specified in §§ 3.81–3.86.

§ 3.419 *Speed limitations for fixed-pitch propellers, ground adjustable pitch propellers, and automatically varying pitch propellers which cannot be controlled in flight.* (a) During take-off and initial climb at best rate-of-climb speed, the propeller, in the case of fixed pitch or ground adjustable types, shall restrain the engine to a speed not exceeding its maximum permissible take-off speed and, in the case of automatic variable-pitch types, shall limit the maximum governed engine revolutions per minute to a speed not exceeding the maximum permissible take-off speed. In demonstrating compliance with this provision the engine shall be operated at full throttle or the throttle setting corresponding to the maximum permissible take-off manifold pressure.

(b) During a closed throttle glide at the placard, "never-exceed speed" (see § 3.739), the propeller shall not cause the engine to rotate at a speed in excess of 110 percent of its maximum allowable continuous speed.

§ 3.420 *Speed and pitch limitations for controllable pitch propellers without constant speed controls.* The stops or other means incorporated in the propeller mechanism to restrict the pitch range shall limit (a) the lowest possible blade pitch to a value which will assure compliance with the provisions of § 3.419 (a), and (b) the highest possible blade pitch to a value not lower than the flattest blade pitch with which compliance with the provisions of § 3.419 (b) can be demonstrated.

§ 3.421 *Variable pitch propellers with constant speed controls.* (a) Suitable means shall be provided at the governor to limit the speed of the propeller. Such means shall limit the maximum governed engine speed to a value not exceeding its maximum permissible take-off revolutions per minute.

(b) The low pitch blade stop, or other means incorporated in the propeller mechanism to restrict the pitch range, shall limit the speed of the engine to a value not exceeding 103 percent of the maximum permissible take-off revolutions per minute under the following conditions:

(1) Propeller blades set in the lowest possible pitch and the governor inoperative.

(2) Engine operating at take-off manifold pressure with the airplane stationary and with no wind.

§ 3.422 *Propeller clearance.* With the airplane loaded to the maximum weight and most adverse center of gravity position and the propeller in the most adverse pitch position, propeller clearances shall not be less than the following, unless smaller clearances are properly substantiated for the particular design involved:

(a) *Ground clearance.* (1) Seven inches (for airplanes equipped with nose wheel type landing gears) or 9 inches (for airplanes equipped with tail wheel type landing gears) with the landing gear statically deflected and the airplane in the level, normal take-off, or taxying attitude, whichever is most critical.

(2) In addition to subparagraph (1) of this paragraph, there shall be positive clearance between the propeller and the ground when, with the airplane in the level take-off attitude, the critical tire is completely deflated and the corresponding landing gear strut is completely bottomed.

(b) *Water clearance.* A minimum clearance of 18 inches shall be provided unless compliance with § 3.147 can be demonstrated with lesser clearance.

(c) *Structural clearance.* (1) One inch radial clearance between the blade tips and the airplane structure, or whatever additional radial clearance is necessary to preclude harmful vibration of the propeller or airplane.

(2) One-half inch longitudinal clearance between the propeller blades or cuffs and stationary portions of the airplane. Adequate positive clearance shall be provided between other rotating portions of the propeller or spinner and stationary portions of the airplane.

FUEL SYSTEM

§ 3.429 *General.* The fuel system shall be constructed and arranged in a manner to assure the provision of fuel to each engine at a flow rate and pressure adequate for proper engine functioning under all normal conditions of operation, including all maneuvers and acrobatics for which the airplane is intended.

ARRANGEMENT

§ 3.430 *Fuel system arrangement.* Fuel systems shall be so arranged as to permit any one fuel pump to draw fuel from only one tank at a time. Gravity feed systems shall not supply fuel to any one engine from more than one tank at a time unless the tank air spaces are interconnected in such a manner as to assure that all interconnected tanks will feed equally. (See also § 3.439.)

§ 3.431 *Multiengine fuel system arrangement.* The fuel systems of multiengine airplanes shall be arranged to permit operation in such a manner that the failure of any one component will not result in the loss of the power of more than one engine. Unless other provisions are made in order to comply with this requirement, the fuel system shall be arranged to permit supplying fuel to each engine through a system entirely independent of any portion of the system supplying fuel to the other engines.

§ 3.432 *Pressure cross feed arrangements.* Pressure cross feed lines shall not pass through portions of the airplane devoted to carrying personnel or cargo, unless means are provided to permit the flight personnel to shut off the supply of fuel to these lines, or unless any joints, fittings, or other possible sources of leakage installed in such lines are enclosed in a fuel- and fume-proof enclosure which is ventilated and drained to the exterior of the airplane. Bare tubing need not be enclosed but shall be protected where necessary against possible inadvertent damage.

OPERATION

§ 3.433 *Fuel flow rate.* The ability of the fuel system to provide the required fuel flow rate and pressure shall be demonstrated when the airplane is in the attitude which represents the most adverse condition from the standpoint of fuel feed and quantity of unusable fuel in the tank. During this test fuel shall be delivered to the engine at the applicable flow rate (see §§ 3.434–3.436) and at a pressure not less than the minimum required for proper carburetor operation.

A suitable mock-up of the system, in which the most adverse conditions are simulated, may be used for this purpose. The quantity of fuel in the tank being tested shall not exceed the amount established as the unusable fuel supply for that tank as determined by demonstration of compliance with the provisions of § 3.437 (see also §§ 3.440 and 3.672), plus whatever minimum quantity of fuel it may be necessary to add for the purpose of conducting the flow test. If a fuel flowmeter is provided, the meter shall be blocked during the flow test and the fuel shall flow through the meter bypass.

§ 3.434 *Fuel flow rate for gravity feed systems.* The fuel flow rate for gravity feed systems (main and reserve supply) shall be 1.2 pounds per hour for each take-off horsepower or 150 percent of the actual take-off fuel consumption of the engine, whichever is greater.

§ 3.435 *Fuel flow rate for pump systems.* The fuel flow rate for pump systems (main and reserve supply) shall be 0.9 pound per hour for each take-off horsepower or 125 percent of the actual take-off fuel consumption of the engine, whichever is greater. This flow rate shall be applicable to both the primary engine-driven pump and the emergency pumps and shall be available when the pump is running at the speed at which it would normally be operating during take-off. In the case of hand-operated pumps, this speed shall be considered to be not more than 60 complete cycles (120 single strokes) per minute.

§ 3.436 *Fuel flow rate for auxiliary fuel systems and fuel transfer systems.* The provisions of § 3.434 or § 3.435, whichever is applicable, shall also apply to auxiliary and transfer systems with the exception that the required fuel flow rate shall be established upon the basis of maximum continuous power and speed instead of take-off power and speed. A lesser flow rate shall be acceptable, however, in the case of a small auxiliary tank feeding into a large main tank, provided a suitable placard is installed to require that the auxiliary tank must only be opened to the main tank when a predetermined satisfactory amount of fuel still remains in the main tank.

§ 3.437 *Determination of unusable fuel supply and fuel system operation on low fuel.* (a) The unusable fuel supply for each tank shall be established as not less than the quantity at which the first evidence of malfunctioning occurs under the conditions specified in this section. (See also § 3.440.) In the case of airplanes equipped with more than one fuel tank, any tank which is not required to feed the engine in all of the conditions specified in this section need be investigated only for those flight conditions in which it shall be used and the unusable fuel supply for the particular tank in question shall then be based on the most critical of those conditions which are found to be applicable. In all such cases, information regarding the conditions under which the full amount of usable fuel in the tank can safely be used shall be made available to the operating personnel by means of a suitable placard or instructions in the Airplane Flight Manual.

(b) Upon presentation of the airplane for test, the applicant shall stipulate the quantity of fuel with which he chooses to demonstrate compliance with this provision and shall also indicate which of the following conditions is most critical from the standpoint of establishing the unusable fuel supply. He shall also indicate the order in which the other conditions are critical from this standpoint:

(1) Level flight at maximum continuous power or the power required for level flight at V_C, whichever is less.

(2) Climb at maximum continuous power at the calculated best angle of climb at minimum weight.

(3) Rapid application of power and subsequent transition to best rate of climb following a power-off glide at 1.3 V_{s_0}.

(4) Sideslips and skids in level flight, climb, and glide under the conditions specified in subparagraphs (1), (2), and (3) of this paragraph, of the greatest severity likely to be encountered in normal service or in turbulent air.

(c) In the case of utility category airplanes, there shall be no evidence of malfunctioning during the execution of all approved maneuvers included in the Airplane Flight Manual. During this test the quantity of fuel in each tank shall not exceed the quantity established as the unusable fuel supply, in accordance with paragraph (b) of this section, plus 0.03 gallon for each maximum continuous horsepower for which the airplane is certificated.

(d) In the case of acrobatic category airplanes, there shall be no evidence of malfunctioning during the execution of all approved maneuvers included in the Airplane Flight Manual. During this test the quantity of fuel in each tank shall not exceed that specified in paragraph (c) of this section.

(e) If an engine can be supplied with fuel from more than one tank, it shall be possible to regain the full power and fuel pressure of that engine in not more than 10 seconds (for single-engine airplanes) or 20 seconds (for multiengine airplanes) after switching to any full tank after engine malfunctioning becomes apparent due to the depletion of the fuel supply in any tank from which the engine can be fed. Compliance with this provision shall be demonstrated in level flight.

(f) There shall be no evidence of malfunctioning during take-off and climb for 1 minute at the calculated attitude of best angle of climb at take-off power and minimum weight. At the beginning of this test the quantity of fuel in each tank shall not exceed that specified in paragraph (c) of this section.

§ 3.438 *Fuel system hot weather operation.* The fuel system shall be so arranged as to minimize the possibility of the formation of vapor lock in the system under all normal conditions of operation.

§ 3.439 *Flow between interconnected tanks.* In the case of gravity feed systems with tanks whose outlets are interconnected, it shall not be possible for fuel to flow between tanks in quantities sufficient to cause an overflow of fuel from the tank vent when the airplane is operated as specified in § 3.437 (a) and the tanks are full.

FUEL TANKS

§ 3.440 *General.* Fuel tanks shall be capable of withstanding without failure any vibration, inertia, and fluid and structural loads to which they may be subjected in operation. Flexible fuel tank liners shall be of an acceptable type. Integral type fuel tanks shall be provided with adequate facilities for the inspection and repair of the tank interior. The total usable capacity of the fuel tanks shall not be less than 1 gallon for each seven maximum continuous rated horsepower for which the airplane is certificated. The unusable capacity shall be considered to be the minimum quantity of fuel which will permit compliance with the provisions of § 3.437. The fuel quantity indicator shall be adjusted to account for the unusable fuel supply as specified in § 3.672. If the unusable fuel supply in any tank exceeds 5 percent of the tank capacity or 1 gallon, whichever is greater, a placard and a suitable notation in the Airplane Flight Manual shall be provided to indicate to the flight personnel that the fuel remaining in the tank when the quantity indicator reads zero cannot be used safely in flight. The weight of the unusable fuel supply shall be included in the empty weight of the airplane.

§ 3.441 *Fuel tank tests.* (a) Fuel tanks shall be capable of withstanding the following pressure tests without failure or leakage. These pressures may be applied in a manner simulating the actual pressure distribution in service:

(1) Conventional metal tanks and nonmetallic tanks whose walls are not supported by the airplane structure: A pressure of 3.5 psi or the pressure developed during the maximum ultimate acceleration of the airplane with a full tank, whichever is greater.

(2) Integral tanks: The pressure developed during the maximum limit acceleration of the airplane with a full tank, simultaneously with the application of the critical limit structural loads.

(3) Nonmetallic tanks the walls of which are supported by the airplane structure: Tanks constructed of an acceptable basic tank material and type of construction and with actual or simulated support conditions shall be subjected to a pressure of 2 psi for the first tank of a specific design. Subsequent tanks shall be production tested to at least 0.5 psi. The supporting structure shall be designed for the critical loads occurring in the flight or landing strength conditions combined with the fuel pressure loads resulting from the corresponding accelerations.

(b) (1) Tanks with large unsupported or unstiffened flat areas shall be capable of withstanding the following tests without leakage or failure. The complete tank assembly, together with its supports, shall be subjected to a vibration test when mounted in a manner simulating the actual installation. The tank assembly shall be vibrated for 25 hours at a total amplitude of not less than 1/32 of an inch while filled ⅔ full of water.

The frequency of vibration shall be 90 percent of the maximum continuous rated speed of the engine unless some other frequency within the normal operating range of speeds of the engine is more critical, in which case the latter speed shall be employed and the time of test shall be adjusted to accomplish the same number of vibration cycles.

(2) In conjunction with the vibration test, the tank assembly shall be rocked through an angle of 15° on either side of the horizontal (30° total) about an axis parallel to the axis of the fuselage. The assembly shall be rocked at the rate of 16 to 20 complete cycles per minute.

(c) Integral tanks which incorporate methods of construction and sealing not previously substantiated by satisfactory test data or service experience shall be capable of withstanding the vibration test specified in paragraph (b) of this section.

(d) (1) Tanks with nonmetallic liners shall be subjected to the sloshing portion of the test outlined under paragraph (b) of this section with fuel at room temperature.

(2) In addition, a specimen liner of the same basic construction as that to be used in the airplane shall, when installed in a suitable test tank, satisfactorily withstand the slosh test with fuel at a temperature of 110° F.

§ 3.442 *Fuel tank installation.* (a) The method of support for tanks shall not be such as to concentrate the loads resulting from the weight of the fluid in the tanks. Pads shall be provided to prevent chafing between the tank and its supports. Materials employed for padding shall be nonabsorbent or shall be treated to prevent the absorption of fluids. If flexible tank liners are employed, they shall be so supported that the liner is not required to withstand fluid loads. Interior surfaces of compartments for such liners shall be smooth and free of projections which are apt to cause wear of the liner, unless provisions are made for protection of the liner at such points or unless the construction of the liner itself provides such protection.

(b) Tank compartments shall be ventilated and drained to prevent the accumulation of inflammable fluids or vapors. Compartments adjacent to tanks which are an integral part of the airplane structure shall also be ventilated and drained.

(c) Fuel tanks shall not be located on the engine side of the fire wall. Not less than one-half inch of clear air space shall be provided between the fuel tank and the fire wall. No portion of engine nacelle skin which lies immediately behind a major air egress opening from the engine compartment shall act as the wall of an integral tank. Fuel tanks shall not be located in personnel compartments, except in the case of single-engine airplanes. In such cases fuel tanks the capacity of which does not exceed 25 gallons may be located in personnel compartments, if adequate ventilation and drainage are provided. In all other cases, fuel tanks shall be isolated from personnel compartments by means of fume and fuel proof enclosures.

§ 3.443 *Fuel tank expansion space.* Fuel tanks shall be provided with an expansion space of not less than 2 percent of the tank capacity, unless the tank vent discharges clear of the aircraft in which case no expansion space will be required. It shall not be possible inadvertently to fill the fuel tank expansion space when the airplane is in the normal ground attitude.

§ 3.444 *Fuel tank sump.* (a) Each tank shall be provided with a drainable sump having a capacity of not less than 0.25 percent of the tank capacity or 1/16 gallon, whichever is greater. The sump may be dispensed with if the fuel system is provided with a sediment bowl which will permit visual ground inspection for accumulation of water or other foreign material. The sediment bowl shall also be readily accessible for drainage. The capacity of the sediment chamber shall not be less than 1 ounce per each 20 gallons of the fuel tank capacity.

(b) If a fuel tank sump is provided, the capacity specified above shall be effective with the airplane in the normal ground attitude.

(c) If a separate sediment bowl is provided, the fuel tank outlet shall be so located that water will drain from all portions of the tank to the outlet when the airplane is in the ground attitude.

§ 3.445 *Fuel tank filler connection.* (a) Fuel tank filler connections shall be marked as specified in § 3.767.

(b) Provision shall be made to prevent the entrance of spilled fuel into the fuel tank compartment or any portions of the airplane other than the tank itself. The filler cap shall provide a fuel-tight seal for the main filler opening. However, small openings in the fuel tank cap for venting purposes or to permit passage of a fuel gauge through the cap shall be permissible.

§ 3.446 *Fuel tank vents and carburetor vapor vents.* (a) Fuel tanks shall be vented from the top portion of the expansion space. Vent outlets shall be so located and constructed as to minimize the possibility of their being obstructed by ice or other foreign matter. The vent shall be so constructed as to preclude the possibility of siphoning fuel during normal operation. The vent shall be of sufficient size to permit the rapid relief of excessive differences of pressure between the interior and exterior of the tank. Air spaces of tanks the outlets of which are interconnected shall also be interconnected. There shall be no undrainable points in the vent line where moisture is apt to accumulate with the airplane in either the ground or level flight attitude. Vents shall not terminate at points where the discharge of fuel from the vent outlet will constitute a fire hazard or from which fumes may enter personnel compartments.

(b) Carburetors which are provided with vapor elimination connections shall be provided with a vent line which will lead vapors back to one of the airplane fuel tanks. If more than one fuel tank is provided and it is necessary to use these tanks in a definite sequence for any reason, the vapor vent return line shall lead back to the fuel tank which must be used first unless the relative capacities of the tanks are such that return to another tank is preferable.

§ 3.447–A ***Fuel tank vents.*** Provision shall be made to prevent excessive loss of fuel during acrobatic maneuvers including short periods of inverted flight. It shall not be possible for fuel to siphon from the vent when normal flight has been resumed after having executed any acrobatic maneuver for which the airplane is intended.

§ 3.448 *Fuel tank outlet.* The fuel tank outlet shall be provided with a screen of from 8 to 16 meshes per inch. If a finger strainer is used, the length of the strainer shall not be less than 4 times the outlet diameter. The diameter of the strainer shall not be less than the diameter of the fuel tank outlet. Finger strainers shall be accessible for inspection and cleaning.

FUEL PUMPS

§ 3.449 *Fuel pump and pump installation.* (a) If fuel pumps are provided to maintain a supply of fuel to the engine, at least one pump for each engine shall be directly driven by the engine. Fuel pumps shall be adequate to meet the flow requirements of the applicable portions of §§ 3.433–3.436.

(b) Emergency fuel pumps shall be provided to permit supplying all engines with fuel in case of the failure of any one engine-driven pump, unless the engine-driven pumps have been approved with the engines, in which case emergency pumps need not be provided. Similarly, if an engine fuel injection pump which has been certificated as an integral part of the engine is used, an emergency pump will not be required. Emergency pumps shall be capable of complying with the same flow requirements as are prescribed for the main pumps. Hand emergency pumps shall not require excessive effort for their continued operation at the rate of 60 complete cycles (120 single strokes) per minute. Emergency pumps shall be available for immediate use in case of the failure of any other pump.

LINES, FITTINGS, AND ACCESSORIES

§ 3.550 *Fuel system lines, fittings, and accessories.* Fuel lines shall be installed and supported in a manner which will prevent excessive vibration and will be adequate to withstand loads due to fuel pressure and accelerated flight conditions. Lines which are connected to components of the airplane between which relative motion might exist shall incorporate provisions for flexibility. Flexible hose shall be of an acceptable type.

§ 3.551 *Fuel valves.* (a) Means shall be provided to permit the flight personnel to shut off rapidly the flow of fuel to any engine individually in flight. Valves provided for this purpose shall be located on the side of the fire wall most remote from the engine.

(b) Shut-off valves shall be so constructed as to make it possible for the flight personnel to reopen the valves rapidly after they have once been closed.

(c) Valves shall be provided with either positive stops or "feel" in the on and off positions and shall be supported in such a manner that loads resulting from their operation or from accelerated flight conditions are not transmitted to the lines connected to the valve. Valves shall be so installed that the effect of gravity and vibration will tend to turn their handles to the open rather than the closed position.

§ 3.552 *Fuel strainer.* A fuel strainer shall be provided between the fuel tank outlet and the carburetor inlet. If an engine-driven fuel pump is provided, the strainer shall be located between the tank outlet and the engine-driven pump inlet. The strainer shall be accessible for drainage and cleaning, and the strainer screen shall be removable.

DRAINS AND INSTRUMENTS

§ 3.553 *Fuel system drains.* Drains shall be provided to permit safe drainage of the entire fuel system and shall incorporate means for locking in the closed position.

§ 3.554 *Fuel system instruments.* (See § 3.655 and §§ 3.670 through 3.673.)

OIL SYSTEM

§ 3.561 *Oil system.* Each engine shall be provided with an independent oil system capable of supplying the engine with an ample quantity of oil at a temperature not exceeding the maximum which has been established as safe for continuous operation. The oil capacity of the system shall not be less than 1 gallon for every 25 gallons of fuel capacity. However, in no case shall the oil capacity be less than 1 gallon for each 75 maximum continuous horsepower of the engine(s) involved unless lower quantities can be substantiated.

§ 3.561–1 *"Capacity" (CAA interpretations which apply to § 3.561).* The word "capacity" as used in § 3.561 is interpreted by the Administrator as follows:

(a) Only the usable fuel system capacity need be considered.

(b) In a conventional oil system (no transfer system provided) only the usable oil tank capacity shall be considered. The quantity of oil in the engine oil lines, the oil radiator, or in the feathering reserve shall not be included. When an oil transfer system is installed, and the transfer pump is so located that it can pump some of the oil in the transfer lines into the main engine oil tanks, the quantity of oil in these lines which can be pumped by the transfer pump may be added to the oil capacity.

[12 F. R. 7438. Correction noted at 14 F. R. 36]

§ 3.562 *Oil cooling.* (See § 3.581 and pertinent sections.)

OIL TANKS

§ 3.563 *Oil tanks.* Oil tanks shall be capable of withstanding without failure all vibration, inertia, and fluid loads to which they might be subjected in operation. Flexible oil tank liners shall be of an acceptable type.

§ 3.564 *Oil tank tests.* Oil tank tests shall be the same as fuel tank tests (see § 3.441), except as follows:

(a) The 3.5 psi pressure specified in § 3.441 (a) shall be 5 pounds psi.

(b) In the case of tanks with nonmetallic liners, the test fluid shall be oil rather than fuel as specified in § 3.441 (d) and the slosh test on a specimen liner shall be conducted with oil at a temperature of 250° F.

§ 3.565 *Oil tank installation.* Oil tank installations shall comply with the requirements of § 3.442 (a) and (b).

§ 3.566 *Oil tank expansion space.* Oil tanks shall be provided with an expansion space of not less than 10 percent of the tank capacity or ½ gallon, whichever is greater. It shall not be possible inadvertently to fill the oil tank expansion space when the airplane is in the normal ground attitude.

§ 3.567 *Oil tank filler connection.* Oil tank filler connections shall be marked as specified in § 3.767.

§ 3.568 *Oil tank vent.* (a) Oil tanks shall be vented to the engine crankcase from the top of the expansion space in such a manner that the vent connection is not covered by oil under any normal flight conditions. Oil tank vents shall be so arranged that condensed water vapor which might freeze and obstruct the line cannot accumulate at any point.

(b) *Category A.* Provision shall be made to prevent hazardous loss of oil during acrobatic maneuvers including short periods of inverted flight.

§ 3.569 *Oil tank outlet.* The oil tank outlet shall not be enclosed or covered by any screen or other guard which might impede the flow of oil. The diameter of the oil tank outlet shall not be less than the diameter of the engine oil pump inlet. (See also § 3.577.)

LINES, FITTINGS, AND ACCESSORIES

§ 3.570 *Oil system lines, fittings, and accessories.* Oil lines shall comply with the provisions of § 3.550, except that the inside diameter of the engine oil inlet and outlet lines shall not be less than the diameter of the corresponding engine oil pump inlet and outlet.

§ 3.571 *Oil valves.* (See § 3.637.)

§ 3.572 *Oil radiators.* Oil radiators and their support shall be capable of withstanding without failure any vibration, inertia, and oil pressure loads to which they might normally be subjected.

§ 3.573 *Oil filters.* If the engine is equipped with an oil filter, the filter shall be constructed and installed in such a manner that complete blocking of the flow through the filter element will not jeopardize the continued operation of the engine oil supply system.

§ 3.574 *Oil system drains.* Drains shall be provided to permit safe drainage of the entire oil system and shall incorporate means for positive locking in the closed position.

§ 3.575 *Engine breather lines.* (a) Engine breather lines shall be so arranged that condensed water vapor which might freeze and obstruct the line cannot accumulate at any point. Breathers shall discharge in a location which will not constitute a fire hazard in case foaming occurs and so that oil emitted from the line will not impinge upon the pilot's windshield. The breather shall not discharge into the engine air induction system.

(b) *Category A.* In the case of acrobatic type airplanes, provision shall be made to prevent excessive loss of oil from the breather during acrobatic maneuvers including short periods of inverted flight.

§ 3.576 *Oil system instruments.* See §§ 3.655, 3.670, 3.671, and 3.674.

§ 3.577 *Propeller feathering system.* If the propeller feathering system is dependent upon the use of the engine oil supply, provision shall be made to trap a quantity of oil in the tank in case the supply becomes depleted due to failure of any portion of the lubricating system other than the tank itself. The quantity of oil so trapped shall be sufficient to accomplish the feathering operation and shall be available only to the feathering pump. The ability of the system to accomplish feathering when the supply of oil has fallen to the above level shall be demonstrated.

COOLING

§ 3.581 *General.* The power-plant cooling provisions shall be capable of maintaining the temperatures of all power-plant components, engine parts, and engine fluids (oil and coolant), at or below the maximum established safe values under critical conditions of ground and flight operation.

TESTS

§ 3.582 *Cooling tests.* Compliance with the provisions of § 3.581 shall be demonstrated under critical ground, water, and flight operating conditions. If the tests are conducted under conditions which deviate from the highest anticipated summer air temperature (see § 3.583), the recorded power-plant temperatures shall be corrected in accordance with the provisions of §§ 3.584 and 3.585. The corrected temperatures determined in this manner shall not exceed the maximum established safe values. The fuel used during the cooling tests shall be of the minimum octane number approved for the engines involved, and the mixture settings shall be those appropriate to the operating conditions. The test procedures shall be as outlined in §§ 3.586 and 3.587.

§ 3.583 *Maximum anticipated summer air temperatures.* The maximum anticipated summer air temperature shall be considered to be 100° F. at sea level and to decrease from this value at the rate of 3.6° F. per thousand feet of altitude above sea level.

§ 3.584 *Correction factor for cylinder head, oil inlet, carburetor air, and engine coolant inlet temperatures.* These temperatures shall be corrected by adding the difference between the maximum anticipated summer air temperature and the temperature of the ambient air at the time of the first occurrence of maximum head, air, oil, or coolant temperature recorded during the cooling test.

§ 3.585 *Correction factor for cylinder barrel temperatures.* Cylinder barrel temperatures shall be corrected by adding 0.7 of the difference between the maximum anticipated summer air temperature and the temperature of the ambient air at the time of the first occurrence of the maximum cylinder barrel temperature recorded during the cooling test.

§ 3.586 *Cooling test procedure for single-engine airplanes.* This test shall be conducted by stabilizing engine temperatures in flight and then starting at the lowest practicable altitude and climbing for 1 minute at take-off power. At the end of 1 minute, the climb shall be continued at maximum continuous power until at least 5 minutes after the occurrence of the highest temperature recorded. The climb shall not be conducted at a speed greater than the best rate-of-climb speed with maximum continuous power unless:

(a) The slope of the flight path at the speed chosen for the cooling test is equal to or greater than the minimum required angle of climb (see § 3.85 (a)), and

(b) A cylinder head temperature indicator is provided as specified in § 3.675.

§ 3.587 *Cooling test procedure for multiengine airplanes*—(a) *Airplanes which meet the minimum one-engine-inoperative climb performance specified in § 3.85 (b).* The engine cooling test for these airplanes shall be conducted with the airplane in the configuration specified in § 3.85 (b), except that the operating engine(s) shall be operated at maximum continuous power or at full throttle when above the critical altitude. After stabilizing temperatures in flight, the climb shall be started at the lower of the two following altitudes and shall be continued until at least 5 minutes after the highest temperature has been recorded:

(1) 1,000 feet below the engine critical altitude or at the lowest practicable altitude (when applicable).

(2) 1,000 feet below the altitude at which the single-engine-inoperative rate of climb is 0.02 $V_{s_0}^2$.

The climb shall be conducted at a speed not in excess of the highest speed at which compliance with the climb requirement of § 3.85 (b) can be shown. However, if the speed used exceeds the speed for best rate of climb with one engine inoperative, a cylinder head temperature indicator shall be provided as specified in § 3.675.

(b) *Airplanes which cannot meet the minimum one-engine-inoperative climb performance specified in § 3.85 (b).* The engine cooling test for these airplanes shall be the same as in paragraph (a) of this section, except that after stabilizing temperatures in flight, the climb (or descent, in the case of airplanes with zero or negative one-engine-inoperative rate of climb) shall be commenced at as near sea level as practicable and shall be conducted at the best rate-of-climb speed (or the speed of minimum rate of descent, in the case of airplanes with zero or negative one-engine-inoperative rate of climb).

LIQUID COOLING SYSTEMS

§ 3.588 *Independent systems.* Each liquid cooled engine shall be provided with an independent cooling system. The cooling system shall be so arranged that no air or vapor can be trapped in any portion of the system, except the expansion tank, either during filling or during operation.

§ 3.589 *Coolant tank.* A coolant tank shall be provided. The tank capacity shall not be less than 1 gallon plus 10 percent of the cooling system capacity. Coolant tanks shall be capable of withstanding without failure all vibration, inertia, and fluid loads to which they may be subjected in operation. Coolant tanks shall be provided with an expansion space of not less than 10 percent of the total cooling system capacity. It shall not be possible inadvertently to fill the expansion space with the airplane in the normal ground attitude.

§ 3.590 *Coolant tank tests.* Coolant tank tests shall be the same as fuel tank tests (see § 3.441), except as follows:

(a) The 3.5 pounds per square inch pressure test of § 3.441 (a) shall be replaced by the sum of the pressure developed during the maximum ultimate acceleration with a full tank or a pressure of 3.5 pounds per square inch, whichever is greater, plus the maximum working pressure of the system.

(b) In the case of tanks with nonmetallic liners, the test fluid shall be coolant rather than fuel as specified in § 3.441 (d), and the slosh test on a specimen liner shall be conducted with coolant at operating temperature.

§ 3.591 *Coolant tank installation.* Coolant tanks shall be supported in a manner so as to distribute the tank loads over a large portion of the tank surface. Pads shall be provided to prevent chafing between the tank and the support. Material used for padding shall be nonabsorbent or shall be treated to prevent the absorption of inflammable fluids.

§ 3.592 *Coolant tank filler connection.* Coolant tank filler connections shall be marked as specified in § 3.767. Provisions shall be made to prevent the entrance of spilled coolant into the coolant tank compartment or any portions of the airplane other than the tank itself. Recessed coolant filler connections shall be drained and the drain shall discharge clear of all portions of the airplane.

§ 3.593 *Coolant lines, fittings, and accessories.* Coolant lines shall comply with the provisions of § 3.550, except that the inside diameter of the engine coolant inlet and outlet lines shall not be less than the diameter of the corresponding engine inlet and outlet connections.

§ 3.594 *Coolant radiators.* Coolant radiators shall be capable of withstanding without failure any vibration, inertia, and coolant pressure loads to which they may normally be subjected. Radiators shall be supported in a manner which will permit expansion due to operating temperatures and prevent the transmittal of harmful vibration to the radiator. If the coolant employed is inflammable, the air intake duct to the coolant radiator shall be so located that flames issuing from the nacelle in case of fire cannot impinge upon the radiator.

§ 3.595 *Cooling system drains.* One or more drains shall be provided to permit drainage of the entire cooling system, including the coolant tank, radiator, and the engine, when the airplane is in the normal ground attitude. Drains shall discharge clear of all portions of the airplane and shall be provided with means for positively locking the drain in the closed position. Cooling system drains shall be accessible.

§ 3.596 *Cooling system instruments.* See §§ 3.655, 3.670, and 3.671.

INDUCTION SYSTEM

§ 3.605 *General.* (a) The engine air induction system shall permit supplying an adequate quantity of air to the engine under all conditions of operation.

(b) Each engine shall be provided with at least two separate air intake sources, except that in the case of an engine equipped with a fuel injector only one air intake source need be provided, if the air intake, opening, or passage is unobstructed by a screen, filter, or other part on which ice might form and so restrict the air flow as to affect adversely engine operation. Primary and alternate air intakes may open within the cowling only if that portion of the cowling is isolated from the engine accessory section by means of a fireproof diaphragm. Alternate air intakes shall be located in a sheltered position. Supplying air to the engine through the alternate air intake system or the carburetor air preheater shall not result in the loss of excessive power in addition to the power lost due to the rise in the temperature of the air.

§ 3.606 *Induction system de-icing and anti-icing provisions.* The engine air induction system shall incorporate means for the prevention and elimination of ice accumulations in accordance with the provisions in this section. It shall be demonstrated that compliance with the provisions outlined in the following paragraphs can be accomplished when the airplane is operating in air at a temperature of 30° F. when the air is free of visible moisture.

(a) Airplanes equipped with sea level engines employing conventional venturi carburetors shall be provided with a preheater capable of providing a heat rise of 90° F. when the engine is operating at 75 percent of its maximum continuous power.

(b) Airplanes equipped with altitude engines employing conventional venturi carburetors shall be provided with a preheater capable of providing a heat rise of 120° F. when the engine is operating at 75 percent of its maximum continuous power.

(c) Airplanes equipped with altitude engines employing carburetors which embody features tending to reduce the possibility of ice formation shall be provided with a preheater capable of providing a heat rise of 100° F. when the engine is operating at 60 percent of its maximum continuous power. However, the preheater need not provide a heat rise in excess of 40° F. if a fluid de-icing system complying with the provisions of §§ 3.607–3.609 is also installed.

§ 3.607 *Carburetor de-icing fluid flow rate.* The system shall be capable of providing each engine with a rate of fluid flow, expressed in pounds per hour, of not less than 2.5 multiplied by the square root of the maximum continuous power of the engine. This flow shall be available to all engines simultaneously. The fluid shall be introduced into the air induction system at a point close to, and upstream from, the carburetor. The fluid shall be introduced in a manner to assure its equal distribution over the entire cross section of the induction system air passages.

§ 3.608 *Carburetor fluid de-icing system capacity.* The fluid de-icing system capacity shall not be less than that required to provide fluid at the rate specified in § 3.607 for a time equal to 3 percent of the maximum endurance of the airplane. However, the capacity need not in any case exceed that required for 2 hours of operation nor shall it be less than that required for 20 minutes of operation at the above flow rate. If the available preheat exceeds 50° F. but is less than 100° F., it shall be permissible to decrease the capacity of the system in proportion to the heat rise available in excess of 50° F.

§ 3.609 *Carburetor fluid de-icing system detail design.* Carburetor fluid de-icing systems shall comply with provisions for the design of fuel systems, except as specified in §§ 3.607 and 3.608, unless such provisions are manifestly inapplicable.

§ 3.610 *Carburetor air preheater design.* Means shall be provided to assure adequate ventilation of the carburetor air preheater when the engine is being operated in cold air. The preheater shall be constructed in such a manner as to permit inspection of exhaust manifold parts which it surrounds and also to permit inspection of critical portions of the preheater itself.

§ 3.611 *Induction system ducts.* Induction system ducts shall be provided with drains which will prevent the accumulation of fuel or moisture in all normal ground and flight attitudes. No open drains shall be located on the pressure side of turbo-supercharger installations. Drains shall not discharge in a location which will constitute a fire hazard. Ducts which are connected to components of the airplane between which relative motion may exist shall incorporate provisions for flexibility.

§ 3.612 *Induction system screens.* If induction system screens are employed, they shall be located upstream from the carburetor. It shall not be possible for fuel to impinge upon the screen. Screens shall not be located in portions of the induction system which constitute the only passage through which air can reach the engine, unless the available preheat is 100° F. or over and the screen is so located that it can be de-iced by the application of heated air. De-icing of screens by means of alcohol in lieu of heated air shall not be acceptable.

EXHAUST SYSTEM

§ 3.615 *General.* (a) The exhaust system shall be constructed and arranged in such a manner as to assure the safe disposal of exhaust gases without the existence of a hazard of fire or carbon monoxide contamination of air in personnel compartments.

(b) Unless suitable precautions are taken, exhaust system parts shall not be located in close proximity to portions of any systems carrying inflammable fluids or vapors nor shall they be located under portions of such systems which may be subject to leakage. All exhaust system components shall be separated from adjacent inflammable portions of the airplane which are outside the engine compartment by means of fireproof shields. Exhaust gases shall not be discharged at a location which will cause a glare seriously affecting pilot visibility at night, nor shall they discharge within dangerous proximity of any fuel or oil system drains. All exhaust system components shall be ventilated to prevent the existence of points of excessively high temperature.

§ 3.616 *Exhaust manifold.* Exhaust manifolds shall be made of fireproof, corrosion-resistant materials, and shall incorporate provisions to prevent failure due to their expansion when heated to operating temperatures. Exhaust manifolds shall be supported in a manner adequate to withstand all vibration and inertia loads to which they might be subjected in operation. Portions of the manifold which are connected to components between which relative motion might exist shall incorporate provisions for flexibility.

§ 3.617 *Exhaust heat exchangers.* (a) Exhaust heat exchangers shall be constructed and installed in such a manner as to assure their ability to withstand without failure all vibration, inertia, and other loads to which they might normally be subjected. Heat exchangers shall be constructed of materials which are suitable for continued operation at high temperatures and which are adequately resistant to corrosion due to products contained in exhaust gases.

(b) Provisions shall be made for the inspection of all critical portions of exhaust heat exchangers, particularly if a welded construction is employed. Heat exchangers shall be ventilated under all conditions in which they are subject to contact with exhaust gases.

§ 3.618 *Exhaust heat exchangers used in ventilating air heating systems.* Heat exchangers of this type shall be so constructed as to preclude the possibility of exhaust gases entering the ventilating air.

FIRE WALL AND COWLING

§ 3.623 *Fire walls.* All engines, auxiliary power units, fuel burning heaters, and other combustion equipment which are intended for operation in flight shall be isolated from the remainder of the airplane by means of fire walls, or shrouds, or other equivalent means.

§ 3.624 *Fire wall construction.* (a) Fire walls and shrouds shall be constructed in such a manner that no hazardous quantity of air, fluids, or flame can pass from the engine compartment to other portions of the airplane. All openings in the fire wall or shroud shall be sealed with close-fitting fireproof grommets, bushings, or fire-wall fittings.

(b) Fire walls and shrouds shall be constructed of fireproof material and shall be protected against corrosion. The following materials have been found to comply with this requirement:

(1) Heat- and corrosion-resistant steel 0.015 inch thick,

(2) Low carbon steel, suitably protected against corrosion, 0.018 inch thick.

§ 3.625 *Cowling.* (a) Cowling shall be constructed and supported in such a manner as to be capable of resisting all vibration, inertia, and air loads to which it may normally be subjected. Provision shall be made to permit rapid and complete drainage of all portions of the cowling in all normal ground and flight attitudes. Drains shall not discharge in locations constituting a fire hazard.

(b) Cowling shall be constructed of fire-resistant material. All portions of the airplane lying behind openings in the engine compartment cowling shall also be constructed of fire-resistant materials for a distance of at least 24 inches aft of such openings. Portions of cowling which are subjected to high temperatures due to proximity to exhaust system ports or exhaust gas impingement shall be constructed of fireproof material.

§ 3.625-1 *Fire-resistant aircraft material (CAA rules which apply to § 3.625).* See § 4b.448-3 of this chapter.

[13 F. R. 7723]

POWER-PLANT CONTROLS AND ACCESSORIES

CONTROLS

§ 3.627 *Power-plant controls.* Power-plant controls shall comply with the provisions of §§ 3.384 and 3.759. Controls shall maintain any necessary position without constant attention by the flight personnel and shall not tend to creep due to control loads or vibration. Flexible controls shall be of an acceptable type. Controls shall have adequate strength and rigidity to withstand operating loads without failure or excessive deflection.

§ 3.628 *Throttle controls.* A throttle control shall be provided to give independent control for each engine. Throttle controls shall afford a positive and immediately responsive means of controlling the engine(s). Throttle controls shall be grouped and arranged in such a manner as to permit separate control of each engine and also simultaneous control of all engines.

§ 3.629 *Ignition switches.* Ignition switches shall provide control for each ignition circuit on each engine. It shall be possible to shut off quickly all ignition on multiengine airplanes, either by grouping of the individual switches or by providing a master ignition control. If a master control is provided, suitable means shall be incorporated to prevent its inadvertent operation.

§ 3.630 *Mixture controls.* If mixture controls are provided, a separate control shall be provided for each engine. The controls shall be grouped and arranged in such a manner as to permit both separate and simultaneous control of all engines.

§ 3.631 *Propeller speed and pitch controls.* (See also § 3.421 (a).) If propeller speed or pitch controls are provided, the controls shall be grouped and arranged in such a manner as to permit control of all propellers, both separately and together. The controls shall permit ready synchronization of all propellers on multiengine airplanes.

§ 3.632 *Propeller feathering controls.* If propeller feathering controls are provided, a separate control shall be provided for each propeller. Propeller feathering controls shall be provided with means to prevent inadvertent operation.

§ 3.633 *Fuel system controls.* Fuel system controls shall comply with requirements of § 3.551 (c).

§ 3.634 *Carburetor air preheat controls.* Separate controls shall be provided to regulate the temperature of the carburetor air for each engine.

ACCESSORIES

§ 3.635 *Power-plant accessories.* Engine-driven accessories shall be of a type satisfactory for installation on the engine involved and shall utilize the provisions made on the engine for the mounting of such units. Items of electrical equipment subject to arcing or sparking shall be installed so as to minimize the possibility of their contact with any inflammable fluids or vapors which might be present in a free state.

§ 3.636 *Engine battery ignition systems.* (a) Battery ignition systems shall be supplemented with a generator which is automatically made available as an alternate source of electrical energy to permit continued engine operation in the event of the depletion of any battery.

(b) The capacity of batteries and generators shall be sufficient to meet the simultaneous demands of the engine ignition system and the greatest demands of any of the airplane's electrical system components which may draw electrical energy from the same source. Consideration shall be given to the condition of an inoperative generator, and to the condition of a completely depleted battery when the generator is running at its normal operating speed. If only one battery is provided, consideration shall also be given to the condition in which the battery is completely depleted and the generator is operating at idling speed.

(c) Means shall be provided to warn the appropriate flight personnel if malfunctioning of any part of the electrical system is causing the continuous discharging of a battery used for engine ignition. (See § 3.629 for ignition switches.)

POWER-PLANT FIRE PROTECTION

§ 3.637 *Power-plant fire protection.* Suitable means shall be provided to shut off the flow in all lines carrying inflammable fluids into the engine compartment.

SUBPART F—EQUIPMENT

§ 3.651 *General.* The equipment specified in § 3.655 shall be the minimum installed when the airplane is submitted to determine its compliance with the airworthiness requirements. Such additional equipment as is necessary for a specific type of operation is specified in other pertinent parts of the Civil Air Regulations, but, where necessary, its installation and that of the items mentioned in § 3.655 is covered herein.

§ 3.652 *Functional and installational requirements.* Each item of equipment which is essential to the safe operation of the airplane shall be found by the Administrator to perform adequately the functions for which it is to be used, shall function properly when installed, and shall be adequately labeled as to its identification, function, operational limitations, or any combination of these, whichever is applicable. Items of equipment for which type certification is required shall have been certificated in accordance with the provisions of Part 15 of this chapter (or previous regulations) and such other parts as may be applicable.

BASIC EQUIPMENT

§ 3.655 *Required basic equipment.* The following table shows the basic equipment items required for type and airworthiness certification of an airplane:

(a) *Flight and navigational instruments.* (1) Air-speed indicator (see § 3.663).

(2) Altimeter.

(3) Magnetic direction indicator (see § 3.666).

(b) *Power-plant instruments*—(1) *For each engine or tank.* (i) Fuel quantity indicator (see § 3.672).

(ii) Oil pressure indicator.

(iii) Oil temperature indicator.

(iv) Tachometer.

(2) *For each engine or tank (if required in reference section).* (i) Carburetor air temperature indicator (see § 3.676).

(ii) Coolant temperature indicator (if liquid-cooled engines used).

(iii) Cylinder head temperature indicator (see § 3.675).

(iv) Fuel pressure indicator (if pumped engines used).

(v) Manifold pressure indicator (if altitude engines used).

(vi) Oil quantity indicator (see § 3.674).

(c) *Electrical equipment (if required by reference section).* (1) Master switch arrangement (see § 3.688).

(2) Adequate source(s) of electrical energy (see §§ 3.682 and 3.685).

(3) Electrical protective devices (see § 3.690).

(d) *Miscellaneous equipment.* (1) Certificated safety belts for all occupants (see Part 15 of this chapter).

(2) Airplane Flight Manual (see § 3.777).

§ 3.655-1 *Air-speed indicators, direction indicators, and altimeters (CAA rules which apply to § 3.655).* See §§ 4b.691-1, 4b.691-6, and 4b.691-8 of this chapter.

[13 F. R. 7725]

INSTRUMENTS; INSTALLATION

GENERAL

§ 3.661 *Arrangement and visibility of instrument installations.* (a) Flight, navigation, and power-plant instruments for use by each pilot shall be easily visible to him.

(b) On multiengine airplanes, identical power-plant instruments for the several engines shall be so located as to prevent any confusion as to the engines to which they relate.

§ 3.662 *Instrument panel vibration characteristics.* Vibration characteristics of the instrument panel shall not be such as to impair the accuracy of the instruments or to cause damage to them.

FLIGHT AND NAVIGATIONAL INSTRUMENTS

§ 3.663 *Air-speed indicating system.* This system shall be so installed that the air-speed indicator shall indicate true air speed at sea level under standard conditions to within an allowable installational error of not more than plus or minus 3 percent of the calibrated air speed or 5 miles per hour, whichever is greater, throughout the operating range of the airplane with flaps up from V_c to 1.3 V_{s_1} and with flaps down at 1.3 V_{s_1}. The calibration shall be made in flight.

§ 3.664 *Air-speed indicator marking.* The air-speed indicator shall be marked as specified in § 3.757.

§ 3.665 *Static air vent system.* All instruments provided with static air case connections shall be so vented that the influence of airplane speed, the opening and closing of windows, air-flow variation, moisture, or other foreign matter will not seriously affect their accuracy.

§ 3.666 *Magnetic direction indicator.* The magnetic direction indicator shall be so installed that its accuracy shall not be excessively affected by the airplane's vibration or magnetic fields. After the direction indicator has been compensated, the installation shall be such that the deviation in level flight does not exceed 10 degrees on any heading. A suitable calibration placard shall be provided as specified in § 3.758.

§ 3.667 *Automatic pilot system.* If an automatic pilot system is installed:

(a) The actuating (servo) devices shall be of such design that they can, when necessary, be positively disengaged from operating the control system or be overpowered by the human pilot to enable him to maintain satisfactory control of the airplane.

(b) A satisfactory means shall be provided to indicate readily to the pilot the alignment of the actuating device in relation to the control system which it operates, except when automatic synchronization is provided.

(c) The manually operated control(s) for the system's operation shall be readily accessible to the pilot.

(d) The automatic pilot system shall be of such design and so adjusted that it cannot produce loads in the control system and surfaces greater than those for which they were designed.

§ 3.667-1 *Automatic pilots (CAA rules which apply to § 3.667).* See § 4b.705-1 of this chapter.

[13 F. R. 7725]

§ 3.668 *Gyroscopic indicators (air-driven type).* All air-driven gyroscopic instruments installed in airplanes which are certificated for instrument flight operations shall derive their energy from a reliable suction source of sufficient capacity to maintain their required accuracy at all speeds above the best rate-of-climb speed. In addition the system shall be so installed as to preclude malfunctioning due to rain, oil, or other detrimental elements. On multiengine airplanes, the following detail requirements shall be applicable:

(a) Two sources actuated by separate means shall be provided, either one of which shall be of sufficient capacity to operate all of the air-driven gyroscopic instruments with which the airplane is equipped, with the airplane in normal cruising attitude at 65 percent maximum continuous power.

(b) A suitable means shall be provided in the attendant installation where the source lines connect into a common line to select either suction air source for the proper functioning of the instruments should failure of one source or a breakage of one source line occur. When an automatic means to permit simultaneous air flow is provided in the system, a suitable method for maintaining suction shall be provided. In order to indicate which source of energy has failed, a visual means shall be provided to indicate this condition to the flight crew.

§ 3.669 *Suction gauge.* A suction gauge shall be provided and so installed as to indicate readily to the flight crew while in flight the suction in inches of mercury which is being applied to the air-driven types of gyroscopic instruments. This gauge shall be connected to the instruments by a suitable system.

POWER-PLANT INSTRUMENTS

§ 3.670 *Operational markings.* Instruments shall be marked as specified in § 3.759.

§ 3.671 *Instrument lines.* Power-plant instrument lines shall comply with the provisions of § 3.550. In addition, instrument lines carrying inflammable fluids or gases under pressure shall be provided with restricted orifices or other safety devices at the source of the pressure to prevent escape of excessive fluid or gas in case of line failure.

§ 3.672 *Fuel quantity indicator.* Means shall be provided to indicate to the flight personnel the quantity of fuel in each tank during flight. Tanks, the outlets and air spaces of which are interconnected, may be considered as one tank and need not be provided with separate indicators. Exposed sight gauges shall be so installed and guarded as to preclude the possibility of breakage or damage. Fuel quantity indicators shall be calibrated to read zero during level flight when the quantity of fuel remaining in the tank is equal to the unusable fuel supply as defined by § 3.437.

[12 F. R. 3438]

§ 3.672-1 *Means to indicate fuel quantity (CAA policies which apply to § 3.672).* The Administrator will accept, as a "means to indicate to the flight personnel the quantity of fuel in each tank during flight," a fuel tank calibrated to read in either gallons or pounds, providing the gauge is clearly marked to indicate which scale is being used.

[12 F. R. 3438. Correction noted at 14 F. R. 86]

§ 3.673 *Fuel flowmeter system.* When a fuel flowmeter system is installed in the fuel line(s), the metering component shall be of such design as to include a suitable means for bypassing the fuel supply in the event that malfunctioning of the metering component offers a severe restriction to fuel flow.

§ 3.674 *Oil quantity indicator.* Ground means, such as a stick gauge, shall be provided to indicate the quantity of oil in each tank. If an oil transfer system or a reserve oil supply system is installed, means shall be provided to indicate to the flight personnel during flight the quantity of oil in each tank.

§ 3.675 *Cylinder head temperature indicating system for air-cooled engines.* A cylinder head temperature indicator shall be provided for each engine on airplanes equipped with cowl flaps. In the case of airplanes which do not have cowl flaps, an indicator shall be provided if compliance with the provisions of § 3.581 is demonstrated at a speed in excess of the speed of best rate of climb.

§ 3.676 *Carburetor air temperature indicating system.* A carburetor air temperature indicating system shall be provided for each altitude engine equipped with a preheater which is capable of providing a heat rise in excess of 60° F.

ELECTRICAL SYSTEMS AND EQUIPMENT

§ 3.681 *Installation.* (a) Electrical systems in airplanes shall be free from hazards in themselves, in their method of operation, and in their effects on other parts of the airplane. Electrical equipment shall be of a type and design adequate for the use intended. Electrical systems shall be installed in such a manner that they are suitably protected from fuel, oil, water, other detrimental substances, and mechanical damage.

(b) Items of electrical equipment required for a specific type of operation are listed in other pertinent parts of the Civil Air Regulations.

BATTERIES

§ 3.682 *Batteries.* When an item of electrical equipment which is essential to the safe operation of the airplane is installed, the battery required shall have sufficient capacity to supply the electrical power necessary for dependable operation of the connected electrical equipment.

§ 3.683 *Protection against acid.* If batteries are of such a type that corrosive substance may escape during servicing or flight, means such as a completely enclosed compartment shall be provided to prevent such substances from coming in contact with other parts of the airplane which are essential to safe operation. Batteries shall be accessible for servicing and inspection on the ground.

§ 3.684 *Battery vents.* The battery container or compartment shall be vented in such manner that gases released by the battery are carried outside the airplane.

GENERATORS

§ 3.685 *Generator.* Generators shall be capable of delivering their continuous rated power.

§ 3.686 *Generator controls.* Generator voltage control equipment shall be capable of dependably regulating the generator output within rated limits.

§ 3.687 *Reverse current cut-out.* A generator reverse current cut-out shall disconnect the generator from the battery and other generators when the generator is developing a voltage of such value that current sufficient to cause malfunctioning can flow into the generator.

MASTER SWITCH

§ 3.688 *Arrangement.* If electrical equipment is installed, a master switch arrangement shall be provided which will disconnect all sources of electrical power from the main distribution system at a point adjacent to the power sources.

§ 3.689 *Master switch installation.* The master switch or its controls shall be so installed that it is easily discernible and accessible to a member of the crew in flight.

PROTECTIVE DEVICES

§ 3.690 *Fuses or circuit breakers.* If electrical equipment is installed, protective devices (fuses or circuit breakers) shall be installed in the circuits to all electrical equipment, except that such items need not be installed in the main circuits of starter motors or in other circuits where no hazard is presented by their omission.

§ 3.691 *Protective devices installation.* Protective devices in circuits essential to safety in flight shall be so located and identified that fuses may be replaced or circuit breakers reset readily in flight.

§ 3.692 *Spare fuses.* If fuses are used, one spare of each rating or 50 percent spare fuses of each rating, whichever is greater, shall be provided.

ELECTRIC CABLES

§ 3.693 *Electric cables.* If electrical equipment is installed, the connecting cables used shall be in accordance with recognized standards for electric cable of a slow burning type and of suitable capacity.

SWITCHES

§ 3.694 *Switches.* Switches shall be capable of carrying their rated current and shall be of such construction that there is sufficient distance or insulating material between current carrying parts and the housing so that vibration in flight will not cause shorting.

§ 3.695 *Switch installation.* Switches shall be so installed as to be readily accessible to the appropriate crew member and shall be suitably labeled as to operation and the circuit controlled.

INSTRUMENT LIGHTS

§ 3.696 *Instrument lights.* If instrument lights are required, they shall be of such construction that there is sufficient distance or insulating material between current carrying parts and the housing so that vibration in flight will not cause shorting. They shall provide sufficient illumination to make all instruments and controls easily readable and discernible, respectively.

§ 3.697 *Instrument light installation.* Instrument lights shall be installed in such a manner that their direct rays are shielded from the pilot's eyes. Direct rays shall not be reflected from the windshield or other surfaces into the pilot's eyes.

LANDING LIGHTS

§ 3.698 *Landing lights.* If landing lights are installed, they shall be of an acceptable type.

§ 3.699 *Landing light installation.* Landing lights shall be so installed that there is no dangerous glare visible to the pilot and also so that the pilot is not seriously affected by halation. They shall be installed at such a location that they provide adequate illumination for night landing.

POSITION LIGHTS

§ 3.700 *Type.* If position lights are installed, they shall be of a type certificated in accordance with Part 15 of this chapter, or shall comply with the pertinent provisions of that part.

§ 3.701 *Forward position light installation.* Forward position lights shall be so installed that, with the airplane in normal flying position, the red light is displayed on the left side and the green light on the right side, each showing unbroken light between two vertical planes the dihedral angle of which is 100 degrees when measured to the left and right, respectively, of the airplane from dead ahead. The lights shall be spaced laterally as far apart as practicable.

§ 3.702 *Rear position light installation.* The rear position light shall be mounted as far aft as practicable and so installed that unbroken light is directed symmetrically aft in such a manner that the axis of the maximum cone of illumination is parallel to the flight path. In addition, the intersection of the two planes forming dihedral angle A given in Part 15 of this chapter shall be vertical.

§ 3.703 *Flashing rear position lights.* If red and white flashing lights are used, in addition to meeting the installation requirements in § 3.702, they shall be located close together.

ANCHOR LIGHTS

§ 3.704 *Anchor light.* When an anchor light is required for seaplanes and amphibians, at least one light shall be provided and it shall be capable of showing a white light for at least 2 miles at night under clear atmospheric conditions.

§ 3.705 *Anchor light installation.* Anchor lights shall be so installed that they will show the maximum unbroken light practicable when the airplane is moored or drifting on the water. Externally hung lights are permitted.

SAFETY EQUIPMENT; INSTALLATION

§ 3.711 *Marking.* Required safety equipment which the crew is expected to operate at a time of emergency, such as flares and automatic life raft releases, shall be readily accessible and plainly marked as to its method of operation. When such equipment is carried in lockers, compartments, or other storage places, such storage places shall be marked for the benefit of passengers and crew.

§ 3.712 *De-icers.* When pneumatic de-icers are installed, the installation shall be in accordance with approved data. Positive means shall be provided for the deflation of the pneumatic boots.

§ 3.713 *Flare requirements.* When parachute flares are required, they shall be of a type certificated in accordance with Part 15 of this chapter.

§ 3.714 *Flare installation.* Parachute flares shall be releasable from the pilot compartment and so installed that danger of accidental discharge is reduced to a minimum. The installation shall be demonstrated in flight to eject flares satisfactorily, except in those cases where inspection indicates a ground test will be adequate. If the flares are ejected so that recoil loads are involved, structural provisions for such loads shall be made.

§ 3.715 *Safety belts.* Safety belts shall be of a type certificated in accordance with Part 15 of this chapter. They shall be so attached that no part of the anchorage will fail at a lower load than specified in § 3.386.

EMERGENCY FLOTATION AND SIGNALING EQUIPMENT

§ 3.716 *Rafts and life preservers.* An approved life raft or approved life preserver, when required by other parts of the Civil Air Regulations, is one approved by either the Administrator, the Bureau of Marine Inspection and Navigation, the United States Army Air Forces, or the Bureau of Aeronautics, Navy Department.

§ 3.716-1 *Life rafts and life preservers (CAA rules which apply to § 3.716).* See §§ 4b.811-1 and 4b.811-2 of this chapter.

[13 F. R. 7725]

§ 3.717 *Installation.* When such emergency equipment is required, it shall be so installed as to be readily available to the crew and passengers. Rafts released automatically or by the pilot shall be attached to the airplane by means of a line to keep them adjacent to the airplane. The strength of the line shall be such that it will break before submerging the empty raft.

§ 3.718 *Signaling device.* Signaling devices, when required by other parts of the Civil Air Regulations, shall be accessible, function satisfactorily, and be free from any hazard in their operation.

RADIO EQUIPMENT; INSTALLATION

§ 3.721 *General.* Radio equipment and installations in the airplane shall be free from hazards in themselves, in their method of operation, and in their effects on other components of the airplane.

MISCELLANEOUS EQUIPMENT; INSTALLATION

§ 3.725 *Accessories for multiengine airplanes.* Engine driven accessories essential to the safe operation of the airplane shall be so distributed among two or more engines that the failure of any one engine will not impair the safe operation of the airplane by the malfunctioning of these accessories.

HYDRAULIC SYSTEMS

§ 3.726 *General.* Hydraulic systems and elements shall be so designed as to withstand, without exceeding the yield point, any structural loads which might be imposed in addition to the hydraulic loads.

§ 3.727 *Tests.* Hydraulic systems shall be substantiated by proof pressure tests. When proof tested, no part of the hydraulic system shall fail, malfunction, or experience a permanent set. The proof load of any system shall be 1.5 times the maximum operating pressure of that system.

§ 3.728 *Accumulators.* Hydraulic accumulators or pressurized reservoirs shall not be installed on the engine side of the fire wall, except when they form an integral part of the engine or propeller.

SUBPART G—OPERATING LIMITATIONS AND INFORMATION

§ 3.735 *General.* Means shall be provided to inform adequately the pilot and other appropriate crew members of all operating limitations upon which the type design is based. Any other information concerning the airplane found by the Administrator to be necessary for safety during its operation shall also be made available to the crew. (See §§ 3.755 and 3.777.)

LIMITATIONS

§ 3.737 *Limitations.* The operating limitations specified in §§ 3.738–3.750 and any similar limitations shall be established for any airplane and made available to the operator as further described in §§ 3.755–3.780, unless its design is such that they are unnecessary for safe operation.

AIR SPEED

§ 3.738 *Air speed.* Air-speed limitations shall be established as set forth in §§ 3.739–3.743.

§ 3.739 *Never-exceed speed (V_{ne}).* This speed shall not exceed the lesser of the following:

(a) 0.9 V_d chosen in accordance with § 3.184.

(b) 0.9 times the maximum speed demonstrated in accordance with § 3.159, but shall not be less than 0.9 times the minimum value of V_d permitted by § 3.184.

§ 3.740 *Maximum structural cruising speed (V_{no}).* This operating limitation shall be:

(a) Not greater than V_c chosen in accordance with § 3.184.

(b) Not greater than 0.89 times V_{ne} established under § 3.739.

(c) Not less than the minimum V_c permitted in § 3.184.

§ 3.741 *Maneuvering speed (V_p).* (See § 3.184.)

§ 3.742 *Flaps-extended speed* (V_{fe}). (a) This speed shall not exceed the lesser of the following:

(1) The design flap speed, V_f, chosen in accordance with § 3.190.

(2) The design flap speed chosen in accordance with § 3.223, but shall not be less than the minimum value of design flap speed permitted in §§ 3.190 and 3.223.

(b) Additional combinations of flap setting, air speed, and engine power may be established, provided the structure has been proven for the corresponding design conditions.

§ 3.743 *Minimum control speed* (V_{mc}). (See § 3.111.)

POWER PLANT

§ 3.744 *Power plant.* The power-plant limitations in §§ 3.745 through 3.747 shall be established and shall not exceed the corresponding limits established as a part of the type certification of the engine and propeller installed in the airplane.

§ 3.745 *Take-off operation.* (a) Maximum rotational speed (revolutions per minute).

(b) Maximum permissible manifold pressure (if applicable).

(c) The time limit upon the use of the corresponding power.

(d) Where the time limit of paragraph (c) of this section exceeds 2 minutes, the maximum allowable temperatures for cylinder head, oil, and coolant outlet if applicable.

§ 3.746 *Maximum continuous operation.* (a) Maximum rotational speed (revolutions per minute).

(b) Maximum permissible manifold pressure (if applicable).

(c) Maximum allowable temperatures for cylinder head, oil, and coolant outlet if applicable.

§ 3.747 *Fuel octane rating.* The minimum octane rating of fuel required for satisfactory operation of the power plant at the limits of §§ 3.745 and 3.746.

AIRPLANE WEIGHT

§ 3.748 *Airplane weight.* The airplane weight and center of gravity limitations are those required to be determined by § 3.71.

MINIMUM FLIGHT CREW

§ 3.749 *Minimum flight crew.* The minimum flight crew shall be established as that number of persons required for the safe operation of the airplane during any contact flight as determined by the availability and satisfactory operation of all necessary controls by each operator concerned.

TYPES OF OPERATION

§ 3.750 *Types of operation.* The type of operation to which the airplane is limited shall be established by the category in which it has been found eligible for certification and by the equipment installed. (See Parts 42 and 43 of this chapter.)

MARKINGS AND PLACARDS

§ 3.755 *Markings and placards.* (a) The markings and placards specified are required for all airplanes. Placards shall be displayed in a conspicuous place and both shall be such that they cannot be easily erased, disfigured, or obscured. Additional informational placards and instrument markings having a direct and important bearing on safe operation may be required by the Administrator when unusual design, operating, or handling characteristics so warrant.

(b) When an airplane is certificated in more than one category, the applicant shall select one category on which all placards and markings on the airplane shall be based. The placard and marking information for the other categories in which the airplane is certificated shall be entered in the Airplane Flight Manual. A reference to this information shall be included on a placard which shall also indicate the category on which the airplane placards and markings are based.

INSTRUMENT MARKINGS

§ 3.756 *Instrument markings.* The instruments listed in §§ 3.757–3.761 shall have the following limitations marked thereon. When these markings are placed on the cover glass of the instrument, adequate provision shall be made to maintain the correct alignment of the glass cover with the face of the dial. All arcs and lines shall be of sufficient width and so located as to be clearly and easily visible to the pilot.

§ 3.757 *Air-speed indicator.* (a) True indicated air speed shall be used:

(1) The never-exceed speed, V_{ne}—a radial red line (see § 3.739).

(2) The caution range—a yellow arc extending from the red line in (1) above to the upper limit of the green arc specified in (3) below.

(3) The normal operating range—a green arc with the lower limit at V_{s_1}, as determined in § 3.82 with maximum weight, landing gear and wing flaps retracted, and the upper limit at the maximum structural cruising speed established in § 3.740.

(4) The flap operating range—a white arc with the lower limit at V_{s_0} as determined in § 3.82 at the maximum weight, and the upper limit at the flaps-extended speed in § 3.742.

(b) When the never-exceed and maximum structural cruising speeds vary with altitude, means shall be provided which will indicate the appropriate limitations to the pilot throughout the operating altitude range.

§ 3.758 *Magnetic direction indicator.* A placard shall be installed on or in close proximity to the magnetic direction indicator which contains the calibration of the instrument in a level flight attitude with engine(s) operating and radio receiver(s) on or off (which shall be stated). The calibration readings shall be those to known magnetic headings in not greater than 30-degree increments.

§ 3.759 *Power-plant instruments.* All required power-plant instruments shall be marked with a red radial line at the maximum and minimum (if applicable) indications for safe operation. The normal operating ranges shall be marked with a green arc which shall not extend beyond the maximum and minimum limits for continuous operation. Take-off and precautionary ranges shall be marked with a yellow arc.

§ 3.760 *Oil quantity indicators.* Indicators shall be suitably marked in sufficient increments so that they will readily and accurately indicate the quantity of oil.

§ 3.761 *Fuel quantity indicator.* When the unusable fuel supply for any tank exceeds 1 gallon or 5 percent of the tank capacity, whichever is greater, a red band shall be placed on the indicator extending from the calibrated zero reading (see § 3.437) to the lowest reading obtainable in the level flight attitude, and a suitable notation in the Airplane Flight Manual shall be provided to indicate to the flight personnel that the fuel remaining in the tank when the quantity indicator reaches zero cannot be used safely in flight. (See § 3.672.)

CONTROL MARKINGS

§ 3.762 *General.* All cockpit controls, with the exception of the primary flight controls, shall be plainly marked as to their function and method of operation.

§ 3.763 *Aerodynamic controls.* The secondary controls shall be suitably marked to comply with §§ 3.337 and 3.338.

§ 3.764 *Power-plant fuel controls.* (a) Controls for fuel tank selector valves shall be marked to indicate the position corresponding to each tank and to all existing cross feed positions.

(b) When more than one fuel tank is provided, and if safe operation depends upon the use of tanks in a specific sequence, the fuel tank selector controls shall be marked adjacent to or on the control to indicate to the flight personnel the order in which the tanks must be used.

(c) On multiengine airplanes, controls for engine valves shall be marked to indicate the position corresponding to each engine.

(d) The capacity of each tank shall be indicated adjacent to or on the fuel tank selector control.

§ 3.765 *Accessory and auxiliary controls.* (a) When a retractable landing gear is used, the indicator required in § 3.359 shall be marked in such a manner that the pilot can ascertain at all times when the wheels are secured in the extreme positions.

(b) Emergency controls shall be colored red and clearly marked as to their method of operation.

MISCELLANEOUS

§ 3.766 *Baggage compartments, ballast location, and special seat loading limitations.* (a) Each baggage or cargo compartment and ballast location shall bear a placard which states the maximum allowable weight of contents and, if applicable, any special limitation of contents due to loading requirements, etc.

(b) When the maximum permissible weight to be carried in a seat is less than 170 pounds (see § 3.74), a placard shall be permanently attached to the seat structure which states the maximum allowable weight of occupants to be carried.

§ 3.767 *Fuel, oil, and coolant filler openings.* The following information shall be marked on or adjacent to the filler cover in each case:

(a) The word "fuel," the minimum permissible fuel octane number for the engines installed, and the usable fuel tank capacity. (See § 3.437.)

(b) The word "oil" and the oil tank capacity.

(c) The name of the proper coolant fluid and the capacity of the coolant system.

§ 3.768 *Emergency exit placards.* Emergency exit placards and operating controls shall be colored red. A placard shall be located adjacent to the control(s) which clearly indicates it to be an emergency exit and describes the method of operation. (See § 3.387.)

§ 3.769 *Approved flight maneuvers*—(a) *Category N.* A placard shall be provided in front of and in clear view of the pilot stating: "No acrobatic maneuvers including spins approved."

(b) *Category U.* A placard shall be provided in front of and in clear view of the pilot stating: "No acrobatic maneuvers approved, except those listed in the Airplane Flight Manual."

(c) *Category A.* A placard shall be provided in clear view of the pilot which lists all approved acrobatic maneuvers and the recommended entry air speed for each. If inverted flight maneuvers are not approved, the placard shall bear a notation to this effect.

§ 3.770 *Airplane category placard.* A placard shall be provided in front of and in clear view of the pilot stating: "This airplane must be operated as a ____________ or ____________ category airplane in compliance with the Airplane Flight Manual."

AIRPLANE FLIGHT MANUAL

§ 3.777 *Airplane Flight Manual.* An Airplane Flight Manual shall be furnished with each airplane. The portions of this document listed below shall be verified and approved by the Administrator, and shall be segregated, identified, and clearly distinguished from portions not so approved. Additional items of information having a direct and important bearing on safe operation may be required by the Administrator when unusual design, operating, or handling characteristics so warrant.

§ 3.778 *Operating limitations*—(a) *Air-speed limitations.* Sufficient information shall be included to permit proper marking of the air-speed limitations on the indicator as required in § 3.757. It shall also include the design, maneuvering speed, and the maximum safe air speed at which the landing gear can be safely lowered. In addition to the above information, the significance of the air speed limitations and of the color coding used shall be explained.

(b) *Power-plant limitations.* Sufficient information shall be included to outline and explain all power-plant limitations (see § 3.744) and to permit marking the instruments as required in § 3.759.

(c) *Weight.* The following information shall be included:

(1) Maximum weight for which the airplane has been certificated,

(2) Airplane empty weight and center of gravity location,

(3) Useful load,

(4) The composition of the useful load, including the total weight of fuel and oil with tanks full.

(d) *Load distribution.* (1) All authorized center of gravity limits shall be stated. If the available space for loading the airplane is adequately placarded or so arranged that any reasonable distribution of the useful load listed in weight above will not result in a center of gravity location outside of the stated limits, this section need not include any other information than the statement of center of gravity limits.

(2) In all other cases this section shall also include adequate information to indicate satisfactory loading combinations which will assure maintaining the center of gravity position within approved limits.

(e) *Maneuvers.* All authorized maneuvers and the appropriate air-speed limitations as well as all unauthorized maneuvers shall be included in accordance with the following:

(1) *Normal category.* All acrobatic maneuvers, including spins, are unauthorized. If the airplane has been demonstrated to be characteristically incapable of spinning in accordance with § 3.124 (d), a statement to this effect shall be entered here.

(2) *Utility category.* All authorized maneuvers demonstrated in the type flight tests shall be listed, together with recommended entry speeds. All other maneuvers are not approved. If the airplane has been demonstrated to be characteristically incapable of spinning in accordance with § 3.124 (d), a statement to this effect shall be entered here.

(3) *Acrobatic category.* All approved flight maneuvers demonstrated in the type flight tests shall be included, together with recommended entry speeds.

(f) *Flight load factor.* The positive limit load factors made good by the airplane's structure shall be described here in terms of accelerations.

(g) *Flight crew.* When a flight crew of more than one is required to operate the airplane safely, the number and functions of the minimum flight crew shall be included.

§ 3.779 *Operating procedures.* This section shall contain information concerning normal and emergency procedures and other pertinent information peculiar to the airplane's operating characteristics which are necessary to safe operation.

§ 3.780 *Performance information.* (a) Information relative to the following items of performance shall be included:

(1) The stalling speed, V_{s_0}, at maximum weight,

(2) The stalling speed, V_{s_1}, at maximum weight and with landing gear and wing flaps retracted,

(3) The take-off distance determined in accordance with § 3.84, including the air speed at the 50-foot height, and the airplane configuration, if pertinent,

(4) The landing distance determined in accordance with § 3.86, including the airplane configuration, if pertinent,

(5) The steady rate of climb determined in accordance with § 3.85 (a), (c), and, as appropriate, (b), including the air speed, power, and airplane configuration, if pertinent.

(b) The effect of variation in (a) (2) with angle of bank up to 60 degrees shall be included.

(c) The calculated approximate effect of variations in subparagraphs (3), (4) and (5) of this paragraph with altitude and temperature shall be included.

§ 3.780-1 *Calculated effects of temperature and altitude variations (CAA policies which apply to § 3.780).* Section 3.780 requires that the calculated effects of variations in temperature and altitude on the take-off distance (§ 3.84 (a) (2)), the landing distance (§ 3.86), and the steady rate of climb (§ 3.85 (a), (b), and (c)), shall be included in the Airplane Flight Manual. The following ranges of these variables will be considered acceptable by the Administrator:

(a) The altitudes and temperatures for which performance in take-off distance, landing distance, take-off climb and balked landing climb shall be calculated are sea level to 7,000 feet and 0° F. to 100° F. respectively, except that take-off and landing distances for a seaplane need not show temperatures below 30° F. at altitudes above 1,000 feet.

(b) For multiengined aircraft, the climb with the critical engine inoperative shall be calculated for an altitude range of sea level to absolute ceiling and a temperature range from 60° F. below the standard temperature to 40° F. above the standard temperature at the altitude involved.

[12 F. R. 3438. Correction noted at 14 F. R. 36]

SUBPART H—IDENTIFICATION DATA

§ 3.791 *Name plate.* A name plate shall be securely attached to and located in the pilot compartment which shall contain:

(a) The manufacturer's name and address.

(b) Model and serial numbers.

(c) Date of manufacture.

(d) Type certificate number.

(e) Production certificate number, (if pertinent).

§ 3.792 *Airworthiness certificate number.* The identifying symbols and registration numbers shall be permanently affixed to the airplane structure in compliance with § 43.10 (c) of this chapter.

PART 4a—AIRPLANE AIRWORTHINESS

SUBPART A—AIRWORTHINESS REQUIREMENTS

GENERAL

AIRWORTHINESS AND TYPE CERTIFICATES

AUTHORITY: §§ 4a.1 to 4a.772 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 601, 603, 52 Stat. 1007, 1009; 49 U. S. C. 551, 553.

SUBPART A—AIRWORTHINESS REQUIREMENTS

SOURCE: §§ 4a.1 to 4a.31 contained in Amendment 48, Civil Air Regulations, 5 F. R. 1834, as amended by Amendment 75, 5 F. R. 3946, except as noted following sections affected.

GENERAL

§ 4a.1 *Scope.* The airworthiness requirements set forth in this part shall be used as a basis for obtaining airworthiness or type certificates: *Provided,* That: (a) Deviations from the requirements of this part which, in the opinion of the Administrator, insure the equivalent condition for safe operation and, (b) equivalent requirements of the United States Army or Navy with respect to airworthiness may be accepted in lieu of the requirements set forth in this part. Unless otherwise specified an amendment to this part will apply only to airplanes for which applications for type certificates are received subsequent to the effective date of such amendment.

§ 4a.2 *Airplane categories.* (a) At the election of the applicant, an airplane may be certificated under the requirements for a particular category according to the intended use of the airplane. Sections of this part which affect only one particular category are designated by a suffix added to the appropriate section numbers, as follows:

Normal category	Suffix N
Transport category	Suffix T
Acrobatic category	Suffix A

(b) All sections not designated by a suffix are applicable to all categories, except as otherwise specified.

[Amdt. 04-3, 7 F. R. 984]

AIRWORTHINESS AND TYPE CERTIFICATES

§ 4a.15 *Requirements for issuance.* The airworthiness requirements specified in this part shall be used as a basis for the certification of airplanes: *Provided,* That an airplane manufactured in accordance with, and conforming to, the currently effective aircraft specifications issued therefor will be eligible for an airworthiness certificate, if the Administrator determines such airplane is in condition for safe operation: *Provided, further,* That an airplane which has not demonstrated compliance with the airworthiness requirements specified in this part but which, in the opinion of the Administrator, is in condition for safe operation for experimental purposes or for particular activities will be eligible for an airworthiness certificate.

§ 4a.16 *Data required for airworthiness certificate.* When an airworthiness certificate is sought and a type certificate is not involved, data which are adequate to establish compliance of the aircraft with the requirements listed in this part shall be submitted to the Administrator.

§ 4a.17 *Data required for type certificate.* Data which are adequate to establish compliance of the aircraft with the airworthiness requirements listed in this part and which are adequate for the reproduction of other airplanes of the same type shall be submitted to the Administrator. The procedure for submitting the required data, the technical contents of such data, and the methods of testing aircraft with respect to the prescribed airworthiness requirements shall be in accordance with Civil Aeronautics Manual 4, Airplane Airworthiness.

§ 4a.18 *Inspection and tests.* Authorized representatives of the Administrator shall have access to the airplane and may witness or conduct such inspections and tests as are deemed necessary by the Administrator.

[Amdt. 48, 5 F. R. 1834, as amended by Amdt. 04a-6, 12 F. R. 1029]

§ 4a.19 *Flight tests.* (Applicable to all airplanes certificated as a type on or after May 15, 1947.) After proof of compliance with the structural requirements contained in this part, and upon completion of all necessary inspection and testing on the ground, and proof of the conformity of the airplane with the type design, and upon receipt from the applicant of a report of flight tests conducted by him, there shall be conducted such official flight tests as the Administrator finds necessary to determine compliance with Subparts C-G. After the conclusion of these flight tests such additional flight tests shall be conducted as the Administrator finds necessary to ascertain whether there is reasonable assurance that the airplane, its components, and equipment are reliable and function properly. The extent of such additional flight tests shall depend upon the complexity of the airplane, the number and nature of new design features, and the record of previous tests and experience for the particular airplane model, its components, and equipment. If practicable, the flight tests performed for the purpose of ascertaining the reliability and proper functioning shall be conducted on the same airplane which was used in flight tests to show compliance with Subparts C-G.

[Amdt. 04a-6, 12 F. R. 1029, as amended by Amdt. 04a-7, 12 F. R. 2087]

§ 4a.20 *Procedure for type certification.* Acceptable procedures for type certification are outlined in Civil Aeronautics Manual 4.

CHANGES

§ 4a.25 *Continued compliance.* Changes to certificated aircraft shall be substantiated to demonstrate continued compliance of the aircraft with the pertinent airworthiness requirements.

§ 4a.26 *Minor changes.* Minor changes to airplanes being manufactured under the terms of a type certificate and which obviously do not impair the condition of the airplane for safe operation may be approved by authorized representatives of the Administrator prior to submittal to the Administrator of any required revised drawings. The approval of such minor changes shall be based on the airworthiness requirements in effect when the particular airplane model was originally certificated, unless, in the opinion of the Administrator, compliance with current airworthiness requirements is necessary.

§ 4a.27 *Major changes.* Major changes to airplanes being manufactured under the terms of a type certificate may require the issuance of a new type certificate and the Administrator may, in his discretion, require such changes to comply with current airworthiness requirements.

§ 4a.28 *Changes required by the Administrator.* (a) In the case of aircraft models approved under the airworthiness requirements in effect prior to the currently effective regulations, the Administrator may require that aircraft submitted for original airworthiness certification comply with such portions of the currently effective regulations as are considered necessary.

(b) All aircraft certificated under the transport category, the manufacture of which is completed after September 30, 1947, shall comply with the following sections of Part 4b of this subchapter, as amended: §§ 4b.58, 4b.442, 4b.445, 4b.447, 4b.449, 4b.450, 4b.478, 4b.484, 4b.503 (c), 4b.516–4b.518, 4b.556, 4b.557, 4b.560, 4b.561, 4b.586, 4b.621–4b.624, 4b.651–4b.655, 4b.661 and 4b.662–4b.676.

[Amdt. 48, 5 F. R. 1834, as amended by Amdt. 04-4, 11 F. R. 11353, Amdt. 04a-8, 12 F. R. 5959]

APPROVAL OF MATERIALS, PARTS, PROCESSES, AND APPLIANCES

§ 4a.31 *Specifications.* (a) Materials, parts, processes, and appliances shall be approved upon a basis and in a manner found necessary by the Administrator to implement the pertinent provisions of the Civil Air Regulations. The Administrator may adopt and publish such specifications as he finds necessary to administer this section, and shall incorporate therein such portions of the aviation industry, Federal, and military specifications respecting such materials, parts, processes, and appliances as he finds appropriate.

(b) Any material, part, process, or appliance shall be deemed to have met the requirements for approval when it meets the pertinent specifications adopted by the Administrator, and the manufacturer so certifies in a manner prescribed by the Administrator.

[Amdt. 04a-1, 12 F. R. 7898]

SUBPART B—DEFINITIONS

SOURCE: §§ 4a.37 to 4a.46 contained in Civil Air Regulations, May 31, 1938, as amended by Amendment 75, 5 F. R. 3946, except as noted following sections affected.

§ 4a.37 *Weights*—(a) *Weight, W.* The total weight of the airplane and its contents.

(b) *Design weight.* The weight of the airplane assumed for purposes of showing compliance with the structural requirements specified in this part.

(c) *Minimum design weight.* Weight empty with standard equipment, plus crew, plus fuel of 0.25 pound per maximum (except take-off) horsepower, plus oil as per capacity.

(d) *Standard weight.* The maximum weight for which the airplane is certificated as complying with all the airworthiness requirements for normal operations.

(e) *Provisional weight.* The maximum weight for which the airplane is certificated as complying with the airworthiness requirements as modified for scheduled air carriers in §§ 4a.687–4a.692.

§ 4a.38 *Structural terms*—(a) *Design wing area, S.* The area enclosed by the projection of the wing outline, including ailerons and flaps but ignoring fairings and fillets, on a surface containing the wing chords. The outline is assumed to extend through nacelles and through the fuselage to the plane of symmetry.

(b) *Design power, P.* The total engine horsepower chosen for use in determining the maneuvering load factors. The corresponding engine output will be incorporated in the aircraft certificate as a maximum operational limitation in all flight operations other than take-off or climbing flight (see § 4a.727).

(c) *Design wing loading, W/S.* The design weight (§ 4a.37 (b)) divided by the design wing area (§ 4a.38 (a)).

(d) *Design power loading, W/P.* The design weight (§ 4a.37 (b)) divided by the design power (see § 4a.38 (b) and Fig. 4a–3).

[CAR, May 31, 1938, as amended by Amdt. 5, 4 F. R. 1171]

§ 4a.39 *Air density, ρ.* The mass density of the air through which the airplane is moving, in terms of the weight of a unit volume of air divided by the acceleration of gravity. The symbol ρ_0 denotes the mass density of air at sea level under standard atmospheric conditions and has the value of 0.002378 slugs per cubic foot.

CROSS REFERENCE: For definition of standard atmosphere, see § 4a.45.

§ 4a.40 *Speed*—(a) *True air speed, V_t.* The velocity of the airplane, along its flight path, with respect to the body of air through which the airplane is moving.

(b) *Indicated air speed, V.* The true air speed multiplied by the term $\sqrt{\rho/\rho_0}$. (See § 4a.39.)

(c) *Design level speed, V_L.* The indicated air speed chosen for use in determining the pertinent structural loading conditions. This value will be incorporated in the aircraft certificate as a maximum operational limitation in level and climbing flight (see § 4a.726).

(d) *Design gliding speed, V_g.* The maximum indicated air speed to be used in determining the pertinent structural loading conditions (see §§ 4a.73 and 4a.726).

(e) *Design stalling speed, V_s.* The computed indicated air speed in unaccelerated flight based on the maximum lift coefficient of the wing and the design gross weight. The effects of slipstreams and nacelles shall be neglected in computing V_s. When high-lift devices are in operation the corresponding stalling speed will be denoted by V_{sf}.

(f) *Design flap speed, V_f.* The indicated air speed at which maximum operation of high-lift devices is assumed (see §§ 4a.73 and 4a.726).

(g) *Maximum vertical speed, V_m.* A fictitious value of indicated air speed computed for unaccelerated flight in a vertical dive with zero propeller thrust.

(h) *Design maneuvering speed, V_p.* The indicated air speed at which maximum operation of the control surfaces is assumed (see § 4a.73).

[CAR, May 31, 1938, as amended by Amdt. 5, 4 F. R. 1171]

§ 4a.41 *Design gust velocity, U.* A specific gust velocity assumed to act normal to the flight path. (See § 4a.76.)

§ 4a.42 *Dynamic pressure, q.* The kinetic energy of a unit volume of air.

$q = \frac{1}{2}\rho V_t^2$ (in terms of true air speed).
$= \frac{1}{2}\rho_0 V^2$ (in terms of indicated air speed).
$= V^2/391$ pounds per square foot, when V is miles per hour indicated air speed.

CROSS REFERENCE: For definition of ρ, see § 4a.39.

§ 4a.43 *Load factors*—(a) *Load factor or acceleration factor, n.* The ratio of a load to the design weight. When the load in question represents the net external load acting on the airplane in a given direction, n represents the acceleration factor in that direction.

(b) *Limit load.* A load (or load factor, or pressure) which it is assumed or known may be safely experienced but will not be exceeded in operation.

(c) *Factor of safety, j.* A factor by which the limit loads are multiplied for various design purposes.

(d) *Ultimate factor of safety, j_u.* A specified factor of safety used in determining the maximum load which the airplane structure is required to support.

(e) *Yield factor of safety, j_y.* A specified factor of safety used in connection with the prevention of permanent deformations.

(f) *Ultimate load.* A limit load multiplied by the specified ultimate factor (or factors) of safety. (See definitions in this section and § 4a.61.)

(g) *Yield load.* A limit load multiplied by the specified yield factor (or factors) of safety. (See definitions in this section and § 4a.62.)

(h) *Strength test.* A static load test in which the ultimate loads are properly applied. (See §§ 4a.61 and 4a.230 (b).)

(i) *Proof test.* A static load test in which the yield loads are properly applied for a period of at least 1 minute. (See § 4a.62.)

(j) *Balancing loads.* Loads by which the airplane is placed in a state of equilibrium under the action of external forces resulting from specified loading conditions. The state of equilibrium thus obtained may be either real or fictitious. Balancing loads may represent air loads, inertia loads, or both. (See § 4a.116.)

§ 4a.44 *Aerodynamic coefficients, C_L, C_M, CP, etc.* The coefficients hereinafter specified are those of the "absolute" (nondimensional) system adopted as standard in the United States. The subscripts N and C used hereinafter refer respectively to directions normal to and parallel with the basic chord of the airfoil section. Other subscripts have the usual significance. When applied to an entire wing or surface, the coefficients represent average values and shall be properly correlated with local conditions (load distribution) as required in § 4a.99.

§ 4a.45 *Standard atmosphere (standard air).* Standard atmosphere refers to that variation of air conditions with altitude which has been adopted as standard in the United States. (See any aeronautics text book or handbook, or NACA Technical Report No. 218.)

§ 4a.46 *Primary structure.* Those portions of the airplane the failure of which would seriously endanger the safety of the airplane.

[Amdt. 5, 4 F. R. 1171]

SUBPART C—STRUCTURAL LOADING CONDITIONS

SOURCE: §§ 4a.61 to 4a.216 contained in Civil Air Regulations, May 31, 1938, as amended by Amdt. 75, 5 F. R. 3946, except as noted following sections affected.

GENERAL STRUCTURAL REQUIREMENTS

§ 4a.61 *Strength.* The primary structure (see § 4a.46) shall be capable of supporting the ultimate loads (see § 4a.43 (f)) determined by the loading conditions and ultimate factors of safety hereinafter specified, the loads being properly distributed and applied.

§ 4a.62 *Deformations.* The primary structure shall be capable of supporting without detrimental permanent deformations, for a period of at least one minute, the yield loads (see § 4a.43 (g)) determined by the loading conditions and yield factors of safety hereinafter specified, the loads being properly distributed and applied. Where no yield factor of safety is specified a factor of 1.0 shall be assumed. In addition, temporary deformations which occur before the yield load is reached shall be of such a nature that their repeated occurrence will not weaken or damage the primary structure.

§ 4a.63 *Stiffness.* The primary structure shall be capable of supporting the limit loads (see § 4a.43 (b)) determined by the loading conditions specified in this part without deflecting beyond whatever limits may be prescribed in this part or which may be deemed necessary by the Administrator for the case in question.

§ 4a.64 *Proof of strength and rigidity.* No general requirements, but see Subpart D for specific requirements.

§ 4a.65 *Materials, fabrication, protection, etc.* No general requirements, but see Subpart E for specific requirements.

FLIGHT LOADS

§ 4a.72 *General.* The airworthiness rating of an airplane with respect to its strength under flight loads will be based on the air speeds and accelerations (from maneuvering or gusts) which can safely be developed in combination. For certain classes of airplanes the acceleration factors and gust velocities are arbitrarily specified hereinafter and shall be used for those classes. The air speeds which can safely be developed in combination with the specified acceleration factors and gusts shall be determined in accordance with the procedure specified in this part and shall serve as a basis for restricting the operation of the airplane in flight. (See § 4a.726.)

AIR SPEEDS

§ 4a.73 *Air speeds.* (See § 4a.40 for definitions.) The design air speeds shall be determined as follows:

(a) V_L (see § 4a.40 (c)).

(b) V_g shall not be less than

$$V_L+K_g\ (V_m-V_L),$$

except that it need not be greater than either V_L+100 miles per hour or 1.5 V_L, whichever is lower. K_g is specified on Figure 4a-1. V_m is defined in § 4a.40 (g). A special ruling may be obtained from the Administrator if the design gliding speed thus determined is greater than 1.33 V_L and appears to be unnecessarily high for the type of airplane involved.

(c) V_f shall not be less than $2V_{sf}$. V_{sf} is defined in § 4a.40 (c).

(d) V_p shall not be less than

$$V_{sf}+K_p\ (V_L-V_{sf}),$$

except that it need not be greater than V_L. K_p is specified on Figure 4a-2.

(e) (See §§ 4a.120, 4a.123, and 4a.125 for exceptions for multiengine airplanes.)

[Amdt. 5, 4 F. R. 1171, as amended by Amdt. 75, 5 F. R. 3946]

LOAD FACTORS

§ 4a.74 *General.* The flight load factors specified in §§ 4a.75–4a.99 shall represent wing load factors. The net load factor, or acceleration factor, shall be obtained by proper consideration of balancing loads acting on the airplane in the specific flight conditions.

§ 4a.75 *Maneuvering load factors.* The limit maneuvering load factors specified in this part (see Fig. 4a-3) are derived largely from experience with conventional types of airplanes and shall be considered as minimum values unless it can be proved, to the satisfaction of the Administrator, that the airplane embodies features of design which make it impossible to develop such values in flight, in which case lower values may be used subject to the approval of the Administrator.

§ 4a.76 *Gust load factors.* The gust load factors shall be computed on the basis of a gust of the magnitude specified, acting normal to the flight path, and proper allowance shall be made for the effects of aspect ratio on the slope of the lift curve. The gust velocities specified shall be used only in conjunction with the gust formulas specified in Civil Aeronautics Manual 4.2121.

[Amdt. 48, 5 F. R. 1835, as amended by Amdt. 75, 5 F. R. 3946]

§ 4a.77 *Factors of safety.* The minimum factors of safety are specified for each loading condition.

CROSS REFERENCE: For multiplying factors of safety required in certain cases, see §§ 4a.207–4a.216.

SYMMETRICAL FLIGHT CONDITIONS (FLAPS RETRACTED)

§ 4a.78 *General.* The flight conditions as set forth in §§ 4a.79–4a.85, together with Table 4a-1, shall be considered as representing the minimum number of conditions required to cover a suitable range of symmetrical flight loadings.

§ 4a.79 *Condition I (positive high angle of attack).* The factors given in Table 4a-1 and Figure 4a-3 for this condition shall be used. To provide for flight conditions critical for the front lift truss or its equivalent the aerodynamic characteristics C_N, CP (or C_M), and C_C shall be determined as follows:

(a) $$C_{N_I}=\frac{n_I\ (W/S)}{q_L}$$

(q_L is dynamic pressure corresponding to V_L; see §§ 4a.40 (c) and 4a.42.)

(b) C_C'=value corresponding to C_{N_I}, or value equal to $-.20\ C_{N_I}$, whichever is greater negatively.

(c) CP'=most forward position of the center of pressure between $C_L=C_{N_I}$ and $C_{L\ \max.}$; when C_{N_I} exceeds $C_{L\ \max.}$, the CP curve shall be extended accordingly.

(d) For biplane combinations the CP of the upper wing shall be assumed to be 2.5 percent of the chord forward of its nominal position.

(e) C_M'=moment coefficient necessary to give the required CP' in conjunction with C_{N_I}.

§ 4a.80 *Condition I_1 (positive high angle of attack modified).* The smaller of the two values of C_C specified in § 4a.79 (b), and the most rearward CP position in the range specified in § 4a.79 (c) shall also be investigated when Condition I is critical for the rear spar (or its equivalent) or if any portion of the front spar (or its equivalent) is likely to be critical in tension. Only the wings and wing bracing need be investigated for this condition.

§ 4a.81 *Condition II (negative high angle of attack).* The factors given in Table 4a-1 for this condition shall be used, with the following provisions:

(a) $$C_{N_{II}}=\frac{n_{II}\ (W/S)}{q_L}$$

(b) C_C=actual value corresponding to $C_{N_{II}}$.

(c) When C_C is positive or has a negative value smaller than 0.02 it may be assumed to be zero.

(d) C_M=actual value corresponding to $C_{N_{II}}$.

§ 4a.82 *Condition III—(a) Positive low angle of attack.* The factors given in Table 4a-1 for this condition shall be used, with the following provisions:

(1) $$C_{N_{III}}=\frac{n_{III}(W/S)}{q_g}.$$

(q_g is dynamic pressure corresponding to V_g; §§ 4a.40 (d) and 4a.42).

(2) C_C=actual value corresponding to $C_{N_{III}}$.

(3) When C_C is positive or has a negative value smaller than 0.02 it may be assumed to be zero.

(4) C_M= actual value corresponding to $C_{N_{III}}$.

(b) *Positive low angle of attack, modified.* If the moment coefficient of the airfoil section at zero lift has a positive value, or a negative value smaller than 0.06, the effects of displaced ailerons on the moment coefficient shall be accounted for in condition III for that portion of the span incorporating ailerons. To cover this point it will be satisfactory to combine 75 percent of the loads acting in condition III with the loads due to a moment coefficient of $-0.08-C_{M_{III}}$ acting over that portion only of the span incorporating ailerons. The design dynamic pressure for the additional moment forces shall be equal to $0.75q_g$. Only the wings and wing bracing need be investigated for this condition.

[CAR, May 31, 1938, as amended by Amdt. 48, 5 F. R. 1835]

§ 4a.83 *Condition IV (negative low angle of attack.)* The factors given in Table 4a-1 for this condition shall be used, with the following provisions:

(a) $C_{N_{IV}}=\frac{n_{IV}(W/S)}{q_g}$

(b) C_C=actual value corresponding to $C_{N_{IV}}$.

(c) When C_C is positive or has a negative value smaller than 0.02 it may be assumed to be zero.

(d) C_M=actual value corresponding to $C_{N_{IV}}$.

[CAR, May 31, 1938, as amended by Amdt. 48, 5 F. R. 1835]

§ 4a.84 *Condition V (inverted flight).* The factors given in Table 4a-1 for this condition shall be used, with the following provisions:

(a) $C_{N_V}=\frac{n_V(W/S)}{q_L}$

(b) $C_C'=0$.

(c) CP'=25 percent.

(d) Only the rear (or single) lift truss system of externally braced wing structures need be investigated for this condition.

§ 4a.85 *Condition VI (gliding).* The factors given in Table 4a-1 shall be used for this condition, with the following provisions:

(a) $C_{N_{VI}}$=value corresponding to $C_{C\ max}$ (positive).

(b) $C_C'=C_{C\ max}$ (positive) + 0.01.

(c) C_M=actual value corresponding to $C_{N_{VI}}$.

(d) The drag of nacelles and other items attached to the wings shall be conservatively estimated and properly included in the investigation of this condition.

(e) Only the wings and wing bracing need be investigated for this condition.

[CAR, May 31, 1938, as amended by Amdt. 48, 5 F. R. 1835]

SYMMETRICAL FLIGHT CONDITIONS (FLAPS OR AUXILIARY DEVICES IN OPERATION)

§ 4a.86 *General.* When flaps or other auxiliary high-lift devices are installed on the wings, the design conditions shall be suitably modified to account for their use in flight. The modifications shall be based on the intended use of such devices and the aerodynamic characteristics of the wing. The conditions as set forth in §§ 4a.87-4a.89, together with Table 4a-2, shall be considered as representing the minimum number of conditions required to cover a suitable range of symmetrical flight loadings in cases where the flaps are used only at relatively low air speeds.

§ 4a.87 *Condition VII (positive gust, flaps deflected).* The factors given in Table 4a-2 for this condition shall be used, with the following provisions:

(a) The most critical deflection of the flap shall be investigated.

(b) The magnitude and distribution of normal, chord, and moment forces over the wing shall correspond to that which would be obtained in developing the specified limit gust load factor at the specified air speed.

[CAR, May 31, 1938, as amended by Amdt. 48, 5 F. R. 1835]

§ 4a.88 *Condition VIII (negative gust, flaps deflected).* The factors given in Table 4a-2 for this condition shall be used, with the following provisions:

(a) The most critical deflection of the flap shall be investigated.

(b) The magnitude and distribution of normal, chord, and moment forces over the wing shall correspond to that which would be obtained in encountering the specified limit gust load factor at the specified air speed.

[CAR, May 31, 1938, as amended by Amdt. 48, 5 F. R. 1835]

§ 4a.89 *Condition IX (dive, flaps deflected).* The factors given in Table 4a-2 for this condition shall be used, with the following provisions:

(a) The most critical deflection of the flap shall be investigated.

(b) The load factor and the magnitude and distribution of normal, chord, and moment forces over the wing shall correspond to the angle of attack at which the greatest rearward chord loads are produced on the wing structure.

(c) Only the wings and wing bracing need be investigated for this condition.

UNSYMMETRICAL FLIGHT CONDITIONS

§ 4a.90 *General.* In the unsymmetrical flight conditions set forth in §§ 4a.91-4a.93, the unbalanced rolling moment shall be assumed to be resisted by the angular inertia of the complete airplane. See Civil Aeronautics Manual 4.2150 for an acceptable alternative procedure.

[Amdt. 48, 5 F. R. 1834, as amended by Amdt. 75, 5 F. R. 3946]

§ 4a.91 *Condition I_u.* Condition I (§ 4a.79) shall be modified by assuming 100 percent of the air load acting on one wing and 40 percent on the other. For airplanes over 1,000 pounds standard weight the latter factor may be increased linearly with standard weight up to 80 percent at 25,000 pounds.

[Amdt. 48, 5 F. R. 1834]

§ 4a.92 *Condition III_u.* Condition III (§ 4a.82) shall be modified as described for condition I_u in § 4a.91.

[Amdt. 48, 5 F. R. 1835]

§ 4a.93 *Condition V_u.* Condition V (§ 4a.84) shall be modified as described for condition I_u in § 4a.91.

SPECIAL FLIGHT CONDITIONS

§ 4a.94 *Gust at reduced weight.* The requirements for gust conditions (excepting tail surface gust conditions) under any loading between minimum and maximum design weight shall be met by primary structure critically loaded thereby.

§ 4a.95 *Lift-wire-cut.* For wings employing wire bracing in the lift truss, Conditions I and III shall be investigated, using load factors n_I and n_{III} of one-half the values specified for these conditions and assuming that any lift wire is out of action. This requirement does not apply to parallel double lift wires, for which case see § 4a.210.

§ 4a.96 *Drag-wire-cut.* Drag struts in double-truss systems shall be designed to withstand the loads developed when the drag wire of the upper system in one bay and the drag wire of the lower system in the adjacent bay are each carrying their limit loads from any flight condition, the remaining wires in these two bays being assumed to be out of action. The minimum ultimate factor of safety shall be 1.5.

§ 4a.97 *Unsymmetrical propeller thrust.* The structure shall incorporate an ultimate factor of safety of 1.5 against failure due to loads caused by maximum (except take-off) power applied on one side of the plane of symmetry only, when power on the other side is off and the airplane is in unaccelerated rectilinear flight.

§ 4a.98 *Wing tanks empty.* If fuel tanks are supported by the wing structure, such structure and its bracing shall also be investigated for conditions I, II, III, and IV with wing tanks empty. The design weight may be reduced by 0.9 pound per certified maximum (except take-off) horsepower.

WING LOAD DISTRIBUTION

§ 4a.99 *Wing load distribution.* The limit air loads and inertia loads acting on the wing structure shall be distributed and applied in a manner closely approximating the actual distribution in flight.

CONTROL SURFACE LOADS

§ 4a.115 *General.* In addition to the flight loads specified in §§ 4a.72-4a.99 the primary structure shall meet the requirements specified in this part to account for the loads acting on the control surfaces. The following loading conditions include the application of balancing loads (§ 4a.43 (j)) derived from the symmetrical flight conditions and also cover the possibility of loading the control surfaces and systems in operating the airplane and by encountering gusts. See also §§ 4a.207-4a.316 for multiplying factors of safety required in certain cases.

HORIZONTAL TAIL SURFACES

§ 4a.116 *Balancing.* The limit load acting on the horizontal tail surface shall not be less than the maximum balancing load obtained from conditions I, II, III, IV, VII, and VIII set forth in §§ 4a.79, 4a.81, 4a.82, 4a.83, 4a.87 and 4a.88. In computing these loads for tail surface design the moments of fuselage and nacelles shall be suitably accounted for. The factors given in Tables 4a-3 shall be used, with the following provisions:

(a) For conditions I, II, III, and IV, P (in Fig. 4a-4) = 40 percent of net balancing load. (This means that the load on the fixed surface should be 140 percent of the net balancing load.) In any case P need not exceed that corresponding to a limit elevator control force of 150 pounds, applied by the pilot.

(b) For conditions VII and VIII, P may be assumed equal to zero.

[Amdt. 48, 5 F. R. 1835]

§ 4a.117 *Maneuvering (horizontal surfaces).* The factors and distributions specified in Table 4a-3 and Fig. 4a-5 for this condition shall be used, together with the following provisions:

(a) The limit unit loading in either direction need not exceed that corresponding to a 200-pound force on the elevator control (see Table 4a-6).

(b) The average limit unit loading shall not be less than 15 pounds per square foot (see Table 4a-3).

[Amdt. 48, 5 F. R. 1835]

§ 4a.118 *Damping (horizontal surfaces).* The total limit load acting down on the fixed surface (stabilizer) in the maneuvering condition (§ 4a.117) shall be applied in accordance with the load distribution of Fig. 4a-6, acting in either direction. The load acting on the movable surface in the maneuvering condition may be neglected in determining the damping loads.

§ 4a.119 *Tab effects (horizontal surfaces).* When a tab is installed so that it can be used by the pilot as a trimming or assisting device, a limit up load over the tab corresponding to the dynamic pressure at V_L and the maximum tab deflection shall be assumed to act in conjunction with the limit down load specified in § 4a.117, disregarding the provisions of § 4a.117 (a), applied over the remaining area. If the control force necessary to balance the resulting loads on the elevator and tab exceeds 200 pounds (Table 4a-6), the loadings over the areas not covered by the tab may be reduced until the control force is equal to this maximum limit value.

[Amdt. 48, 5 F. R. 1835]

VERTICAL TAIL SURFACES

§ 4a.120 *Maneuvering.* The factors given in Table 4a-4 and Fig. 4a-5 for this condition shall be used, with the following provisions:

(a) If the propeller axes are not in the plane of symmetry, the design speed shall not be less than the maximum speed in level flight with any engine inoperative.

(b) The limit unit loading in either direction need not exceed that corresponding to the maximum limit control force (Table 4a-6) except as modified by paragraph (c) of this section.

(c) In any case the average limit unit loading shall not be less than the minimum pressure specified in Table 4a-4 for this condition.

§ 4a.121 *Damping (vertical surfaces).* The total limit load acting on the fixed surface (fin) in the maneuvering condition shall be applied in accordance with the load distribution of Fig. 4a-6, acting in either direction. The load acting on the movable surface in the maneuvering condition may be neglected in determining the damping loads.

§ 4a.122 *Gusts (vertical surfaces).* The gust conditions specified in Table 4a-4 shall be applied, using the following formulas and provisions:

(a) The gust shall be assumed to be sharp-edged and to act normal to the plane of symmetry in either direction.

(b) The average limit unit pressure, $\bar{w}$, developed in striking the gust shall be determined from the following formula:

$$\bar{w} = UVm/575,$$

where

$\bar{w}$ is in pounds per square foot,
U is in feet per second,
V is in miles per hour, and
m = slope of lift curve, C_L per radian, corrected for aspect ratio. The aspect ratio shall not be taken as less than 2.0 in any case.

(c) This condition applies only to that portion of the vertical surface which has a well-defined leading edge.

(d) The chord distribution extending over the fixed and movable surfaces shall simulate that for a symmetrical airfoil, except that the distribution in Fig. 4a-6 may be used where applicable.

§ 4a.123 *Tab effects (vertical surfaces).* (a) When a tab is installed on the vertical movable tail surface so that it can be used by the pilot as a trimming device the limit unit loading over the entire vertical tail surfaces shall not be less than that corresponding to the maximum deflection of the tab together with simultaneous application of the following control force in a direction assisting the tab action:

(1) For airplanes with all propeller axes in the plane of symmetry, zero.

(2) For airplanes with propeller axes not in the plane of symmetry, 200 pounds.

(b) The factors specified in Table 4a-4 for this condition shall be used, with the following exception:

(1) If the propeller axes are not in the plane of symmetry, the design speed V_L specified in Table 4a-4 may be reduced to the maximum speed in level flight with any engine inoperative.

§ 4a.124 *Special cases (vertical surfaces).* A special ruling shall be obtained from the Administrator when an automatic pilot is used on airplanes with propeller axes not in the plane of symmetry.

AILERONS

§ 4a.125 *Maneuvering.* The factors given in Table 4a-5 and Fig. 4a-7 for this condition shall be used, with the following provisions:

(a) If the propeller axes are not in the plane of symmetry, the design speed shall not be less than the maximum speed in level flight with any engine inoperative.

(b) The limit unit loading in either direction need not exceed that corresponding to the maximum control force (Table 4a-6) resisted by only one aileron, except as modified by paragraph (c) of this section.

(c) In any case the average limit unit loading shall not be less than the minimum pressure specified in Table 4a-5 for this condition.

§ 4a.126 *Tab effects (ailerons).* (Applies only to airplanes with propeller axes not in the plane of symmetry.) When a tab is installed on one or both ailerons so that it can be used by the pilot to assist in moving the ailerons, the limit unit loading over both ailerons shall be of sufficient magnitude and in such direction as to hold the ailerons in equilibrium with the tab or tabs deflected to the maximum position. The factors specified in Table 4a-5 for this condition shall be used.

§ 4a.127 *Flying conditions (ailerons).* The ailerons and their control system shall be capable of meeting all requirements specified in the basic symmetrical flying conditions so far as the latter produce symmetrical loads on the ailerons.

WING FLAPS AND TABS

§ 4a.128 *Wing flaps.* Wing flaps shall be loaded in accordance with conditions VII and VIII (§§ 4a.87, 4a.88) and in addition shall be capable of developing an ultimate factor of safety of at least 1.5 with respect to any intermediate conditions which are more severe for any part of the flap or its operating mechanism.

§ 4a.129 *Tabs.* The limit forces acting on control-surface tabs shall be determined from the most severe combination of airplane speed and tab normal force coefficient likely to be obtained for any usable loading condition of the airplane and at speeds up to the design gliding speeds, V_g. An ultimate factor of safety of at least 1.5 shall be maintained.

SPECIAL DEVICES

§ 4a.130 *Special devices.* Special rulings shall be obtained from the Administrator in connection with the design and analysis of wing-slot structures, spoilers, unconventional ailerons, auxiliary airfoils, and similar devices. Requests for special rulings shall be accompanied by suitable drawings or sketches of the structure in question, together with general information and an outline of the method by which it is proposed to determine the structural loading.

CONTROL SYSTEM LOADS

§ 4a.137 *General.* All control systems shall be designed for limit loads 25 percent greater than those corresponding to the limit loads specified for the control surfaces to which they are attached, assuming the movable surface to be in that position which produces the greatest load in the control system, except that the maximum and minimum control force limits in Table 4a-6 shall apply as specified in this part. The factors of safety specified in Table 4a-6 shall be used.

CROSS REFERENCES: For multiplying factors of safety required in certain cases, see §§ 4a.207-4a.216. For operation requirements for control systems, see § 4a.271.

§ 4a.138 *Control wires or push rods.* The forces in the control wires or push rods operating the movable surfaces shall be computed and their effect on the rest of the structure shall be investigated and allowed for in the design of such structure.

§ 4a.139 *Elevator systems.* In applying § 4a.137 the control force specified in Table 4a-6 and Fig. 4a-8 shall be assumed to act in a fore-and-aft direction and shall be applied at the grip of a control stick, or shall be equally divided between two diametrically opposite points on the rim of a control wheel.

§ 4a.140 *Rudder systems.* In applying § 4a.137 the control force specified in Table 4a-6 shall be assumed to act in a direction which will produce the greatest load in the control system and shall be applied at the point of contact of the pilot's foot.

§ 4a.141 *Aileron systems.* In applying § 4a.137 it shall be assumed that the ailerons are loaded in opposite directions. The control force specified in Table 4a-6 and Fig. 4a-9 shall be assumed to act in a lateral direction at the grip of a control stick, or shall be assumed to act as part of couple equal to the specified force multiplied by the diameter of a control wheel. The following assumptions shall be made:

(a) For nondifferential ailerons, 75 percent of the stick force or couple shall be assumed to be resisted by a down aileron, the remainder by the other aileron; also, as a separate condition, 50 percent shall be assumed to be resisted by an up aileron, the remainder by the other aileron.

(b) For differential ailerons, 75 percent of the stick force or couple shall be assumed to be resisted by each aileron in either the up or down position, or rational assumptions based on the geometry of the system shall be made.

§ 4a.142 *Flap and tab control systems.* In applying § 4a.137 suitable minimum manual forces shall be assumed to act on flap and tab control systems and other similar controls.

GROUND LOADS

§ 4a.147 *General.* The conditions set forth in §§ 4a.148–4a.156 represent the minimum amount of investigation required for conventional (tail down type) landing gear. For unconventional types it may be necessary to investigate other landing attitudes, depending on the arrangement, and design of the landing gear members. Consideration will be given to a reduction of the specified limit load factors when it can be proved that the shock absorbing system will positively limit the acceleration factor to a definite lower value in the drop test specified in § 4a.148 (b). The minimum factors of safety are specified for each loading condition. See also §§ 4a.207 through 4a.216 for multiplying factors of safety required in certain cases.

§ 4a.148 *Level landing.* The minimum limit load factor is specified in Fig. 4a-10. The resultant of the ground reaction shall be assumed to be a force lying at the intersection of the plane of symmetry and a plane in which are located the axles and the center of gravity of the airplane less chassis. The propeller axis (or equivalent reference line) shall be assumed horizontal and the basic value of the vertical component of the resultant of the ground reaction shall be equal to the gross weight of the airplane minus chassis and wheels. The horizontal component shall be of the magnitude required to give the resultant force the specified direction except that it need not be greater than 25 percent of the vertical component. The resultant of the ground reaction shall be assumed to be divided equally between wheels and to be applied at the axle at the center of the wheel. The shock-absorber unit and tires shall be assumed to be deflected to half their total travel, unless it is apparent that a more critical arrangement could exist. The minimum ultimate factor of safety shall be 1.5.

(a) *Sliding element.* If a sliding element instead of a rolling element is used for the landing gear, a horizontal component of one-half of the vertical component shall be used to represent the effect of ground friction, except that ski gear which is designed and used only for landing on snow and ice may be designed for the same horizontal component as wheel gear.

(b) *Energy absorption.* The level landing condition specified in § 4a.148 shall be assumed to be produced by a free drop, in inches, equal to 0.36 times the calculated stalling speed (V_s) in miles per hour, except that the height of free drop shall not be less than 18 inches for airplanes employing devices which increase the normal sinking speed, but need not exceed 18 inches when such devices are not employed. The height of free drop is measured from the bottom of the tire to the ground, with the landing gear extended to its extreme unloaded position. (See §§ 4a.278, 4a.475.)

§ 4a.151 *Three-point landing.* The minimum limit load factor is specified in Fig. 4a-10. The value of the sum of the static ground reactions shall be the gross weight of the airplane less chassis. The total load shall be divided between the chassis and tail skid or wheel in inverse proportion to the distances, measured parallel to the ground line, from the center of gravity of the airplane less chassis to the points of contact with the ground. The load on the chassis shall be divided equally between wheels. Loads shall be assumed to be perpendicular to the ground line in the three-point landing attitude, with all shock absorbers and tires deflected to the same degree as in level landing. The tail wheel or skid installation shall also be investigated for this condition. The minimum ultimate factor of safety shall be 1.5.

§ 4a.152 *Energy absorption.* The three-point landing condition specified in § 4a.151 shall be assumed to be produced by a free drop as specified under § 4a.148 (b). This requires shock absorption by both main wheels and tail wheel (or skid). (See §§ 4a.278, 4a.475.)

§ 4a.153 *Side load.* The minimum limit load factor shall be 0.667. The weight of the airplane shall be assumed to act on one wheel in a direction perpendicular to the ground. In addition, a side component of equal magnitude shall be assumed to act inward and normal to the plane of symmetry at the point of contact of the wheel, and an aft component equal to 0.55 times the vertical component shall be assumed to act parallel to the ground at such point. The airplane shall be assumed to be in a three-point attitude with the shock absorbers deflected to their static position and the tires deflected one-quarter the nominal diameter of their cross section. The minimum ultimate factor of safety shall be 1.5.

§ 4a.154 *One-wheel landing.* An investigation of the fuselage structure is required for a one-wheel landing, in which only those loads obtained on one side of the fuselage in the level landing condition are applied. The resulting load factor is therefore one-half of the level landing load factor. (This condition is identical with the level landing condition insofar as the landing gear structure is concerned.) The minimum ultimate factor of safety shall be 1.5.

§ 4a.155 *Braked landing.* The minimum limit load factor shall be 1.33. Airplanes equipped with brakes shall be investigated for the loads incurred when a landing is made with the wheels locked and the airplane is in an attitude such that the tail skid or wheel just clears the ground. The weight of the airplane less chassis shall be assumed to act on the wheels in a direction perpendicular to the ground line in this attitude. In addition, a component parallel to the ground line shall be assumed to act at the point of contact of the wheels and the ground, the magnitude of this component being equal to the weight of the airplane less chassis times a coefficient of friction of 0.55. The tire in all cases shall be assumed to have deflected not more than one-quarter the nominal diameter of its cross section, and the deflection of the shock absorbers shall be the same as in level landing. The minimum ultimate factor of safety shall be 1.5.

§ 4a.156 *Side loads on tail wheel or skid.* Suitable assumptions shall be made to cover side loads acting on tail skids or tail wheels which are not free to swivel or which can be locked or steered by the pilot.

WATER LOADS

§ 4a.161 *General.* The requirements set forth in §§ 4a.162–4a.177 shall apply to the entire airplane, but have particular reference to hull structures, wings, nacelles, and float supporting structure. The requirements for certification of floats as individual items of equipment are specified in Part 15 of this subchapter. The minimum factors of safety are specified for each loading condition.

CROSS REFERENCES: For multiplying factors of safety required in certain cases, see §§ 4a.207–4a.216. For detail design requirements for hulls and floats, see §§ 4a.488–4a.492.

FLOAT SEAPLANES

§ 4a.162 *Landing with inclined reactions (float seaplanes).* The vertical component of the limit load factor shall be 4.20 except that it need not exceed a value given by the following formula:

$$n = 3.0 + 0.133\ W/S.$$

The propeller axis (or equivalent reference line) shall be assumed to be horizontal and the resultant water reaction to be acting in the plane of symmetry and passing through the center of gravity of the airplane less floats and float bracing, but inclined so that its horizontal component is equal to one-quarter of its vertical component. The forces representing the weights of and in the airplane shall be assumed to act in a direction parallel to the water reaction. The weight of the floats and float bracing may be deducted from the gross weight of the airplane.

§ 4a.163 *Float attachment members.* For the design of float attachment members, including the members necessary to complete a rigid brace truss through the fuselage, the minimum ultimate factor of safety shall be 1.85. For the remaining structural members the minimum ultimate factor of safety shall be 1.50.

§ 4a.164 *Landing with vertical reactions (float seaplanes).* The limit load factor shall be 4.33, acting vertically, except that it need not exceed a value given by the following formula:

$$n=3.0+0.133\ W/S.$$

The propeller axis (or equivalent reference line) shall be assumed to be horizontal, and the resultant water reaction to be vertical and passing through the center of gravity of the airplane less floats and float bracing. The weight of the floats and float bracing may be deducted from the gross weight of the airplane.

§ 4a.165 *Safety factors.* The minimum factors of safety shall be the same as those specified in § 4a.163.

§ 4a.166 *Landing with side load (float seaplanes).* The vertical component of the limit load factor shall be 4.0, to be applied to the gross weight of the airplane less floats and float bracing. The propeller axis (or equivalent reference line) shall be assumed to be horizontal and the resultant water reaction shall be assumed to be in the vertical plane which passes through the center of gravity of the airplane less floats and float bracing and is perpendicular to the propeller axis. The vertical load shall be applied through the keel or keels of the float or floats, and evenly divided between the floats when twin floats are used. A side load equal to one-fourth of the vertical load shall be applied along a line approximately half way between the bottom of the keel and the level of the water line at rest. When built-in struts are used, check calculations shall be made for the built-in struts with the side load at the level of the water line at rest. When twin floats are used, the entire side load specified shall be applied to the float on the side from which the water reaction originates. The minimum ultimate factor of safety shall be 1.50.

BOAT SEAPLANES

§ 4a.167 *Local bottom pressures*—(a) *Maximum local pressure.* The maximum value of the limit local pressure shall be determined from the following equation:

$$p_{max}=0.055\ V_s^{1.4}\left(1+\frac{W}{50{,}000}\right)^{1/4}$$

where

p=pressure, pounds per square inch

V_s=stalling speed, flaps down, power on, in miles per hour. (To be calculated on the basis of wind tunnel data or flight tests on previous airplanes.)

W=design weight

The minimum ultimate factor of safety shall be 1.5.

(b) *Variation in local pressure.* The local pressures to be applied to the hull bottom shall vary in accordance with Figure 4a–11. No variation from keel to chine (beamwise) shall be assumed, except when the chine flare indicates the advisability of higher pressures of the chine.

(c) *Application of local pressure.* The local pressure determined from § 4a.167 (a) and Figure 4a–11 shall be applied over a local area in such a manner as to cause the maximum local loads in the hull bottom structure.

[Amdt. 48, 5 F. R. 1836]

§ 4a.168 *Distributed bottom pressures.* (a) For the purpose of designing frames, keels, and chine structure, the limit pressures obtained from § 4a.167 (a) and Figure 4a–11 shall be reduced to one-half the "local" values and simultaneously applied over the entire hull bottom. The loads so obtained shall be carried into the side-wall structure of the hull proper, but need not be transmitted in a fore-and-aft direction as shear and bending loads. The minimum ultimate factor of safety shall be 1.5.

(b) *Unsymmetrical loading.* Each floor member or frame shall be designed for a load on one side of the hull centerline equal to the most critical symmetrical loading, combined with a load on the other side of the hull center line equal to one-half of the most critical symmetrical loading.

[Amdt. 48, 5 F. R. 1836]

§ 4a.169 *Step loading condition*—(a) *Application of load.* The resultant water load shall be applied vertically in the plane of symmetry so as to pass through the center of gravity of the airplane (in full load condition).

(b) *Acceleration.* The limit acceleration shall be 4.33.

(c) *Hull shear and bending loads.* The hull shear and bending loads shall be computed from the inertia loads produced by the vertical water load. To avoid excessive local shear loads and bending moments near the point of water load application, the water load may be distributed over the hull bottom, using pressures not less than those specified in § 4a.168 (a). The minimum ultimate factor of safety shall be 1.5.

[Amdt. 48, 5 F. R. 1836]

§ 4a.170 *Bow loading condition*—(a) *Application of load.* The resultant water load shall be applied in the plane of symmetry at a point one-tenth of the distance from the bow to the step and shall be directed upward and rearward at an angle of 30 degrees from the vertical.

(b) *Magnitude of load.* The magnitude of the limit resultant water load shall be determined from the following equation:

$$P_b=\tfrac{1}{2}n_sW_e,$$

where

P_b=load in pounds,

n_s=step landing load factor,

W_e=effective weight which is assumed equal to one-half the design weight of the airplane.

(c) *Hull shear and bending loads.* The hull shear and bending loads shall be determined by proper consideration of the inertia loads which resist the linear and angular accelerations involved. To avoid excessive local shear loads, the water reaction may be distributed over the hull bottom, using pressures not less than those specified in § 4a.168 (a). The minimum ultimate factor of safety shall be 1.5.

[Amdt. 48, 5 F. R. 1836]

§ 4a.171 *Stern loading condition*—(a) *Application of load.* The resultant water load shall be applied vertically in the plane of symmetry and shall be distributed over the hull bottom from the second step forward with an intensity equal to the pressures specified in § 4a.168 (a).

(b) *Magnitude of load.* The limit resultant load shall equal three-quarters of the design weight of the airplane.

(c) *Hull shear and bending loads.* The hull shear and bending loads shall be determined by assuming the hull structure to be supported at the wing attachment fittings and neglecting internal inertia loads. This condition need not be applied to the fittings or to the portion of the hull ahead of the rear attachment fittings. The minimum ultimate factor of safety shall be 1.5.

[Amdt. 48, 5 F. R. 1836]

§ 4a.172 *Side loading condition*—(a) *Application of load.* The resultant water load shall be applied in a vertical plane through the center of gravity. The vertical component shall be assumed to act in the plane of symmetry and the horizontal component at a point half way between the bottom of the keel and the load water line at design weight (at rest).

(b) *Magnitude of load.* The limit vertical component of acceleration shall be 3.25 and the side component shall be equal to 15 percent of the vertical component.

(c) *Hull shear and bending loads.* The hull shear and bending loads shall be determined by proper consideration of the inertia loads or by introducing couples at the wing attachment points. To avoid excessive local shear loads, the water reaction may be distributed over the hull bottom, using pressures not less than those specified in § 4a.168 (a). The minimum ultimate factor of safety shall be 1.5.

[Amdt. 48, 5 F. R. 1836]

SEAPLANE FLOAT LOADS

§ 4a.173 *Seaplane float loads.* Each main float of a float seaplane shall be capable of carrying the following loads when supported at the attachment fittings as installed on the airplane. The minimum ultimate factor of safety shall be 1.5.

(a) A limit load, acting upward, applied at the bow end of the float and of magnitude equal to one-half of that portion of the airplane gross weight normally supported by the particular float.

(b) The limit load specified in paragraph (a) of this section, acting upward at the stern.

(c) A limit load, acting upward, applied at the step and of magnitude equal to 1.33 times that portion of the airplane gross weight normally supported by the particular float.

[Amdt. 5, 4 F. R. 1171]

§ 4a.174 *Seaplane float bottom loads.* Main seaplane float bottoms shall be designed to withstand the following loads. The minimum ultimate factor of safety shall be 1.5.

(a) A limit load of at least 5.33 pounds per square inch over that portion of the bottom lying between the first step and a section at 25 percent of the distance from the step to the bow.

(b) A limit load of at least 2.67 pounds per square inch over that portion of the bottom lying between the section at 25 percent of the distance from the step to the bow and a section at 75 percent of the distance from the step to the bow.

(c) A limit load of at least 2.67 pounds per square inch over that portion of the bottom lying between the first and second steps. If only one step is used, this load shall extend over that portion of the bottom lying between the step and a section at 50 percent of the distance from the step to the stern.

WING-TIP FLOAT LOADS

§ 4a.175 *Wing-tip float loads.* Wing-tip floats and their attachment, including the wing structure, shall be analyzed for each of the following conditions, using a minimum ultimate factor of safety of 1.5:

(a) A limit load acting vertically up at the completely submerged center of buoyancy and equal to three times the completely submerged displacement.

(b) A limit load inclined upward at 45 degrees to the rear and acting through the completely submerged center of buoyancy and equal to three times the completely submerged displacement.

(c) A limit load acting parallel to the water surface (laterally) applied at the center of area of the side view and equal to one and one-half times the completely submerged displacement.

§ 4a.176 *Wing structure.* The primary wing structure shall incorporate sufficient extra strength to insure that failure of wing-tip float attachment members occurs before the wing structure is damaged.

MISCELLANEOUS WATER LOADS

§ 4a.177 *Sea wing loads.* Special rulings shall be obtained from the Administrator for the strength requirements for sea wings.

SPECIAL LOADING CONDITIONS

§ 4a.187 *Engine torque.* In the case of engines having five or more cylinders the stresses due to the torque load shall be multiplied by a limit load factor of 1.5. For 4-, 3-, and 2-cylinder engines the limit load factors shall be 2, 3, and 4, respectively. The torque acting on the airplane structure shall be computed for the take-off power desired and the propeller speed corresponding thereto (see § 4a.727). The engine mount and forward portion of the fuselage and nacelles shall be designed for this condition. The minimum ultimate factor of safety shall be 1.5 unless higher factors are deemed necessary by the Administrator in order to make special provision for conditions such as vibration, stress concentration, and fatigue.

[Amdt. 5, 4 F. R. 1171, as amended by Amdt. 75, 5 F. R. 3946]

§ 4a.188 *High angle of attack and torque.* The limit loads determined from § 4a.187 shall be considered as acting simultaneously with 75 percent of the limit loads determined from condition I (§ 4a.79). The engine mount, nacelles, and forward portion of the fuselage (when a nose engine is installed) shall be designed for this condition. The minimum ultimate factor of safety shall be 1.5.

§ 4a.189 *Engine mounts, nacelles, etc.* The engine mounts, nacelles, and forward portion of the fuselage (when a nose engine is installed) shall be investigated for the limit loads determined from condition I (see §§ 4a.79 and 4a.94) acting simultaneously with the limit loads due to the engine torque determined in accordance with § 4a.187, except that the engine power and the propeller speed shall correspond to the design power (§ 4a.38 (b)) or the output specified for climbing flight (see § 4a.727), whichever is higher. The minimum ultimate factor of safety shall be 1.5.

[Amdt. 5, 4 F. R. 1171]

§ 4a.190 *Side load on engine mount.* The limit load factor for this condition shall be equal to one-third of the limit load factor for flight condition I (§ 4a.79) but shall in no case be less than 1.33. The engine mount and forward section of the fuselage and nacelles shall be analyzed for this condition, considering the limit load to be produced by inertia forces. The minimum ultimate factor of safety shall be 1.5.

§ 4a.191 *Up load on engine mount.* For engine mounts the limit load in each member shall be arbitrarily assumed as 50 percent of that in the level landing condition but of opposite sign. The minimum ultimate factor of safety will be 1.5.

§ 4a.192 *Passenger loads.* Passenger loads in the accelerated flight conditions shall be computed for a standard passenger weight of 170 pounds and a minimum ultimate factor of safety of 1.50 shall be used, except that seats and berths need not be designed for the reduced weight gust conditions specified in § 4a.94. This shall not exempt the primary structure from such gust conditions.

§ 4a.193 *Structures with safety belts.* Structures to which safety belts are attached shall be capable of withstanding an ultimate load of 1,000 pounds per person applied through the safety belt and directed upward and forward at an angle of 45 degrees with the floor line.

§ 4a.194 *Local loads.* The primary structure shall be designed to withstand local loads caused by dead weights and control loads. Baggage compartments shall be designed to withstand loads corresponding to the maximum authorized capacity. The investigation of dead weight loads shall include a sufficient number of reduced weight gust conditions to insure that the most severe combinations have been investigated.

CROSS REFERENCE: For standard weights, see § 4a.771.

§ 4a.195 *Rigging loads.* Structures braced by wires (or tie-rods) shall be capable of developing an ultimate factor of safety of 1.5 with respect to the limit loads due to rigging the wires to 20 percent of their rated strength (strength of wire, not terminal). When the structure is such that all wires cannot be simultaneously rigged to 20 percent of their rated loads, a rigging condition shall be assumed in which the average of the rigging loads, expressed in percent, equals 20. (See also § 4a.211.) The above condition need not be superimposed on other loading conditions, but the Administrator may require additional investigation for residual rigging loads when such investigation appears necessary. (See also § 4a.253.)

§ 4a.196 *Air loads on struts.* External wing-brace struts which are at an angle of more than 45 degrees with the plane of symmetry and which have a cross-sectional fineness ratio of more than 3 shall be assumed to act as lifting air foils and shall be designed to carry the resultant transverse loads in combination with the specified axial loads. In computing the limit loads the strut sections shall be assumed to have a normal force coefficient equal to 1.0 and the total air load shall be based on the exposed area of the strut. The chord components and vertical reactions of such air load and the lift contributed by the strut shall not be considered in the analysis of the wing.

MULTIPLYING FACTORS OF SAFETY

§ 4a.207 *General.* In addition to the minimum factors of safety specified for each loading condition, the multiplying factors specified in Table 4a–7 and §§ 4a.208–4a.216 shall be incorporated in the structure. The total factor of safety required for any structural component or part equals the minimum factor of safety specified for the loading condition in question multiplied by the factors of safety hereinafter specified, except that certain multiplying factors may be included in others, as indicated in Table 4a–7.

§ 4a.208 *Fittings.* All fittings in the primary structure shall incorporate the multiplying factor of safety specified in Table 4a–7. For this purpose fittings are defined as parts used to connect one primary member to another and shall include the bearing of those parts on the members thus connected. Continuous joints in metal plating and welded joints between primary structural members are not classified as fittings. (See also §§ 4a.320, 4a.321.)

§ 4a.209 *Castings.* All castings used in the primary structure shall incorporate a multiplying factor of safety not less than that specified in Table 4a–7.

§ 4a.210 *Parallel double wires.* When parallel double wires are used in wing lift trusses each wire shall incorporate a multiplying factor of safety not less than that specified in Table 4a–7.

§ 4a.211 *Wires at small angles.* Wire or tie-rod members of wing or tail surface external bracing shall incorporate a multiplying factor of safety computed as follows:

$K = L/2R$ (except that K shall not be less than 1.0)

where

K = the additional factor.

R = the reaction resisted by the wire in a direction normal to the wing or tail surface plane, and

L = the load required in the wire to balance the reaction R.

§ 4a.212 *Double drag trusses.* Whenever double drag trussing is employed, all drag wires shall incorporate a multiplying factor of safety varying linearly from 3.0, when the ratio of overhang to root chord of overhang is 2.0 or greater, to 1.20 when such ratio is 1.0 or less, assuming an equal division of drag load between the two systems.

§ 4a.213 *Torque tubes used as hinges.* When steel torque tubes are employed in direct bearing against strap-type hinges they shall incorporate a multiplying factor of safety at the hinge point not less than that specified in Table 4a-7. (See also § 4a.448.)

§ 4a.214 *Control surface hinges and control system joints.* Control surface hinges and control system joints subjected to angular motion, excepting ball or roller bearings and Army-Navy standard parts used in cable control systems, shall incorporate multiplying factors of safety not less than those specified in Table 4a-7 with respect to the ultimate bearing strength of the softest material used as a bearing. For ball or roller bearings a yield factor of safety of 1.0 with respect to the manufacturer's non-Brinell rating is considered sufficient to provide an adequate ultimate factor of safety.

§ 4a.215 *Wire sizes.* (See §§ 4a.319, 4a.322, 4a.335.)

§ 4a.216 *Wing lift truss system.* All structural members of the wing lift truss system which transmit direct loads from the landing gear shall, in the landing conditions, incorporate a multiplying factor of safety not less than that specified in Table 4a-7.

[Amdt. 5, 4 F. R. 1170]

SUBPART D—PROOF OF STRUCTURE

SOURCE: §§ 4a.227 to 4a.299 contained in Civil Air Regulations, May 31, 1938, as amended by Amendment 75, 5 F. R. 3946, except as noted following sections affected.

§ 4a.227 *General.* Proof of compliance with the loading requirements outlined in Subpart C shall be made in a manner satisfactory to the Administrator and may consist of structural analyses, load tests, flight tests, references to previously approved structures, or combinations of the above. Any condition which can be shown to be noncritical need not be further investigated.

§ 4a.228 *Proof of structural analysis.* (a) Structural analyses will be accepted as complete proof of strength only in the case of structural arrangements for which experience has shown such analyses to be reliable. References shall be given for all methods of analysis, formulas, theories, and material properties which are not generally accepted as standard. The acceptability of a structural analysis will depend to some extent on the excess strength incorporated in the structure.

(b) The structural analysis shall be based on guaranteed minimum mechanical properties of the materials specified on the drawings, except in cases where exact mechanical properties of the materials used are determined.

(c) The effects of welding, form factors, stress concentrations, discontinuities, cutouts, instability, end fixity of columns and vibration shall be accounted for when such factors are present to such an extent as to influence the strength of the structure.

§ 4a.229 *Combined structural analysis and tests.* In certain cases it will be satisfactory to combine structural analysis procedure with the results of load tests of portions of the structure not subject to accurate analysis. In such cases test results shall be reduced to correspond to the mechanical properties of the materials actually used in the airplane. When a unit other than the specific one tested is incorporated in the airplane presented for certification, test results shall be reduced to correspond to the minimum guaranteed mechanical properties of the materials specified on the drawings.

§ 4a.230 *Load tests.* Proof of compliance with structural loading requirements by means of load tests only is acceptable: *Provided,* That strength and proof tests (see § 4a.43 (h) and (i)) are conducted to demonstrate compliance with §§ 4a.61, 4a.62, respectively: *And further provided,* That the following paragraphs of this section are complied with:

(a) The tests shall be supplemented by special tests or analyses to prove compliance with multiplying factor of safety requirements. (See §§ 4a.207-4a.216.)

(b) When a unit other than the specific one tested is incorporated in the airplane presented for certification, the results of strength tests shall be reduced to correspond to the minimum guaranteed mechanical properties of the materials specified on the drawings, unless test loads are carried at least 15 percent beyond the required values.

(c) The determination of test loads, the apparatus used, and the methods of conducting the tests shall be satisfactory to the Administrator.

(d) The tests shall be conducted in the presence of a representative of the Administrator unless otherwise directed by the Administrator.

§ 4a.231 *Flight load tests.* Proof of strength by means of flight load tests will not be accepted unless the necessity therefor is established and the test methods are proved suitable to the satisfaction of the Administrator.

§ 4a.232 *Load tests required.* The following load tests are required in all cases and shall be made in the presence of a representative of the Administrator unless otherwise directed by the Administrator:

(a) Strength tests of wing ribs. (See § 4a.248.)

(b) Pressure tests of fuel and oil tanks. (See § 4a.608.)

(c) Proof tests of tail and control surfaces. (See §§ 4a.263, 4a.264.)

(d) Proof and operating tests of control systems. (See §§ 4a.269, 4a.271.)

WINGS

§ 4a.237 *Proof of wings.* The strength of stressed-skin wings shall be substantiated by load tests (§ 4a.230) or by combined structural analysis and tests (§ 4a.229). The torsional rigidity of the wings shall be within a range of values satisfactory for the prevention of flutter. Compliance with such torsional rigidity requirement shall be demonstrated by static tests or other methods acceptable to the Administrator.

[Amdt. 98, 6 F. R. 1145]

§ 4a.238 *Redundancies.* Wing cellules in which the division of loading between lift trusses and drag trusses is indeterminate shall be analyzed either by an acceptable method for indeterminate structures or by making assumptions which result in conservative design loads for all members.

BEAMS

§ 4a.239 *Beams.* The points set forth in §§ 4a.240-4a.246 shall be covered in the proof of strength of wing beams, in addition to any special types of possible failure peculiar to the structure.

§ 4a.240 *Secondary bending.* When axial loads are present the required minimum ultimate factor of safety shall be introduced before the computation of the bending moments in order to insure that the required ultimate loads can be supported by the structure.

§ 4a.241 *Lateral buckling.* The ability of beams to resist lateral buckling shall be proved.

§ 4a.242 *Webs.* The strength of shear webs shall be proved

§ 4a.243 *Axial load.* When axial load is present tests are required to determine the effective "EI" in the case of truss-type beams and beams having unconventional web construction.

§ 4a.244 *Joint slippage in wood beams.* When a joint in a wood beam is designed to transmit bendin- from one section of the beam to another or to the fuselage, the stresses in each part of the structure shall be calculated on the assumption that the joint is 100 percent efficient (except in mid-bay for which see § 4a.334) and also under the assumption that the bending moment transmitted by the joint is 75 percent of that obtained under the assumption of perfect continuity. Each part of the structure shall be designed to carry the most severe loads determined from the above assumptions.

§ 4a.245 *Bolt holes.* In computing the area, moment of inertia, etc., of wood beams pierced by bolts, the diameter of the bolt hole shall be assumed to be one-sixteenth inch greater than the diameter of the bolt.

§ 4a.246 *Box beams.* In computing the ability of box beams to resist bending loads only that portion of the web with its grain parallel to the beam axis and one-half of that portion of the web with its grain at an angle of 45 degrees to the beam shall be considered. The more conservative method of neglecting the web entirely may be employed.

DRAG TRUSSES

§ 4a.247 *Drag trusses.* Drag struts shall be assumed to have an end fixity coefficient of 1.0 except in cases of unusually rigid restraint, in which a coefficient of 1.5 may be used.

RIBS

§ 4a.248 *Ribs.* The strength of ribs shall be proved by tests to at least 125 percent of the ultimate loads for the most severe loading conditions, except that consideration will be given to structural analyses in conjunction with suitable specimen test data when it can be demonstrated to the satisfaction of the Administrator that it is impractical to simulate the actual loading conditions in a static test. Such analyses shall, on the basis of guaranteed minimum material properties, show proof of strength at 125 percent of the required ultimate loads. The following points shall also apply in proving the strength of ribs.

§ 4a.249 *Load distribution.* The load shall be suitably distributed between upper and lower wing surfaces unless a more severe distribution is used.

§ 4a.250 *Ailerons and high-lift devices.* The effects of ailerons and high-lift devices shall be properly accounted for.

§ 4a.251 *Rib tests.* Rib tests shall simulate conditions in the airplane with respect to torsional rigidity of spars, fixity conditions, lateral support, and attachment to spars.

COVERING

§ 4a.252 *Covering.* Proof of strength of fabric covering is not required when standard grades of cloth and methods of attaching and doping are employed: *Provided, however,* That the Administrator may require special tests when it appears necessary to account for the effects of unusually high design air speeds or slipstream velocities, or similar factors. When metal covering is employed its ability to perform its structural function shall be demonstrated by tests of typical panels or by other means acceptable to the Administrator. In particular, compliance with § 4a.62 requires demonstration of the behavior of the covering under load in order to determine the effects of temporary deformations (wrinkles).

§ 4a.252-1 *Aircraft fabric (CAA rules which apply to § 4a.252).* See § 4b.302-1 and § 4b.302-2 of this subchapter.

[Supp. 1, 13 F. R. 7725]

NONPARALLEL WIRES

§ 4a.253 *Nonparallel wires.* When two or more wires are attached to a common point on the wing, but are not parallel, proper allowance for redundancies and the effects of rigging shall be made.

TAIL AND CONTROL SURFACES

§ 4a.263 *Proof of tail and control surfaces.* Structural analyses of tail and control surfaces will be accepted as complete proof of compliance with ultimate load requirements only when the structure conforms with conventional types for which reliable analytical methods are available. Proof tests as defined in § 4a.43 (i) are required to prove compliance with yield load requirements.

(a) Control surface tests shall include the horn or fitting to which the control system is attached.

(b) In the analysis of control surfaces proper allowance shall be made for rigging loads in brace wires in cases where the counter wires do not go slack before the ultimate load is reached.

(c) Analyses or individual load tests shall be conducted to demonstrate compliance with the multiplying factor of safety requirements outlined in §§ 4a.207–4a.216 for control surface hinges and brace wires.

§ 4a.264 *Vibration tests.* The natural frequencies of vibration of the wings, fuselage, and control surfaces shall be within such ranges of values as are satisfactory for the prevention of flutter. Compliance with this requirement shall be demonstrated by vibration tests or other methods acceptable to the Administrator.

[Amdt 98, 6 F. R. 1145]

CONTROL SYSTEMS

§ 4a.269 *Proof of control systems.* Structural analyses of control systems will be accepted as complete proof of compliance with ultimate load requirements only when the structure conforms with conventional types for which reliable analytical methods are available. Proof tests as defined in § 4a.43 (i) are required to prove compliance with yield load requirements.

§ 4a.270 *Control system tests.* In control system tests, the direction of test loads shall be such as to produce the most severe loading of the control system structure. The tests shall include all fittings, pulleys, and brackets used to attach the control system to the primary structure.

§ 4a.271 *Operation test.* An operation test shall be conducted by operating the controls from the pilot's compartment with the entire system so loaded as to correspond to the minimum limit control force specified in item 3 of Table 4a–6 for the control system in question. In this test there shall be no jamming, excessive friction, or excessive deflection.

[Amdt. 48, 5 F. R. 1836]

§ 4a.272 *Control system joints.* Analyses or individual load tests shall be conducted to demonstrate compliance with the multiplying factor of safety requirements specified in §§ 4a.207 through 4a.216 for control system joints subjected to angular motion.

LANDING GEAR

§ 4a.277 *Proof of landing gear.* Structural analyses of landing gear will be accepted as complete proof of compliance with load requirements only when the structure conforms with conventional types for which reliable analytical methods are available. Analyses may be used to demonstrate compliance with the energy absorption requirements in certain cases. When such analyses are not applicable, dynamic tests shall be conducted to demonstrate compliance with energy absorption requirements.

§ 4a.278 *Energy absorption tests.* When tests for energy absorption are required they shall be so conducted as to simulate the landing conditions for which energy absorption requirements are specified in § 4a.475, and test data shall be obtained from which the maximum acceleration developed at the center of gravity of the airplane can be determined. When drop tests of wheels, tires, and shock absorbers are conducted in a combination differing from that employed on the airplane, proper allowance and corrections shall be made for the errors thus introduced.

HULLS AND FLOATS

§ 4a.283 *Proof of hulls and floats.* Structural analyses of hulls and auxiliary floats will be accepted as complete proof of compliance with load requirements only when the structure conforms with conventional types for which reliable analytical methods are available. The strength of the structure as a whole and its ability to distribute water loads from the bottom plating into the main structural members shall be demonstrated. See Part 15 of this subchapter for the requirements for main floats.

FUSELAGES AND ENGINE MOUNTS

§ 4a.289 *Proof of fuselages and engine mounts.* Structural analyses of fuselages and engine mounts will be accepted as complete proof of compliance with load requirements only when the structure conforms with conventional types for which reliable analytical methods are available.

§ 4a.290 *Critical column loads.* The end fixity coefficient used in determining critical column loads shall in no case exceed 2.0. A value of 1.0 shall be used for all members in the engine mount. In doubtful cases, tests are required to substantiate the degree of restraint assumed.

§ 4a.291 *Baggage compartments.* The ability of baggage compartments to sustain the maximum authorized baggage loads under all required flight and landing conditions shall be demonstrated.

FITTINGS AND PARTS

§ 4a.297 *Proof of fittings and parts.* Proof of strength of all fittings and joints of the primary structure is required. Where applicable, structural analysis methods may be used. When such methods are inadequate, a load test is required. Compliance with the multiplying factor of safety requirements for fittings (§§ 4a.207–4a.216) shall be demonstrated.

§ 4a.298 *Fittings and attaching members.* Since the system of forces which designs a fitting does not necessarily include the forces which design the attaching members, all the forces acting in all the specified conditions shall be considered for every fitting. The strength of each part of a built-up fitting shall be investigated and proper allowance shall be made for the effects of eccentric loading when initially present or when introduced by deflection of the structure under load.

§ 4a.299 *Bolts.* The allowable bearing load assumed for the threaded portion of a bolt shall not exceed 25 percent of the rated shear strength of the bolt.

SUBPART E—DETAIL DESIGN AND CONSTRUCTION

SOURCE: §§ 4a.301 to 4a.513 contained in Civil Air Regulations, May 31, 1938, as amended by Amendment 75, 5 F. R. 3946, except as noted following sections affected.

§ 4a.301 *General.* The primary structure and all mechanisms essential to the safe operation of the airplane shall not incorporate design details which experience has shown to be unreliable or otherwise unsatisfactory. The suitability of all design details shall be established to the satisfaction of the Administrator. Certain design features which have been found to be essential to the airworthiness of an airplane are specified in this subpart and shall be observed.

§ 4a.301-1 *Combustion heaters (CAA rules which apply to § 4a.301).* See § 4b.445-1 of this chapter.

[Supp. 4, 14 F. R. 3305]

MATERIALS, WORKMANSHIP, AND FABRICATION METHODS

§ 4a.302 *Materials and workmanship.* The primary structure shall be made from materials which experience or conclusive tests have proved to be uniform in quality and strength and to be otherwise suitable for airplane construction. Workmanship shall be of sufficiently high grade as to insure proper continued functioning of all parts.

§ 4a.303 *Fabrication methods.* The methods of fabrication employed in constructing the primary structure shall be such as to produce a uniformly sound structure which shall also be reliable with respect to maintenance of the original strength under reasonable service conditions.

§ 4a.304 *Gluing.* Gluing may be used except in cases where inferior joints might result or where proper protection from moisture cannot be shown.

§4a.305 *Torch welding.* Torch welding of primary structural parts may be used only for ferrous materials and for such other materials shown to be suitable therefor.

§ 4a.306 *Electric welding.* Electric arc, spot, or seam welding may be used in the primary structure when specifically approved by the Administrator for the application involved. Requests for approval of the use of electric welding shall be accompanied by information as to the extent to which such welding is to be used, drawings of the parts involved, apparatus employed, general methods of control and inspection, and references to test data substantiating the strength and suitability of the welds obtained.

§ 4a.307 *Brazing and soldering.* The use of brazing and soldering in joining parts of the primary structure is prohibited except that brazing may be used in special cases when the suitability of the method and application can be definitely established to the satisfaction of the Administrator.

§ 4a.308 *Protection.* All members of the primary structure shall be suitably protected against deterioration or loss of strength in service due to corrosion, abrasion, vibration, or other causes. This applies particularly to design details and small parts. In seaplanes special precautions shall be taken against corrosion from salt water, particularly where parts made from different metals are in close proximity. All exposed wood structural members shall be given at least two protective coatings of varnish or approved equivalent. Built-up box spars and similar structures shall be protected on the interior by at least one coat of varnish or approved equivalent and adequate provisions for drainage shall be made. Due care shall be taken to prevent coating of the gluing surfaces.

§ 4a.309 *Inspection.* Inspection openings of adequate size shall be provided for such vital parts of the aircraft as require periodic inspection.

JOINTS, FITTINGS, AND CONNECTING PARTS

§ 4a.312 *Joints, fittings, and connecting parts.* In each joint of the primary structure the design details shall be such as to minimize the possibility of loosening of the joint in service, progressive failure due to stress concentration, and damage caused by normal servicing and field operations.

CROSS REFERENCE: For multiplying factors of safety required, see § 4a.208.

§ 4a.313 *Bolts, pins, and screws.* All bolts and screws in the structure shall be of uniform material of high quality and of first-class workmanship. Machine screws shall not be used in the primary structure unless specifically approved for such use by the Administrator. The use of an approved locking device or method is required for all bolts, pins, and screws.

§ 4a.314 *Wood screws.* The use of wood screws in the primary structure is prohibited except in special cases when the suitability of the particular application is proved to the satisfaction of the Administrator.

§ 4a.315 *Eyebolts.* Special eyebolts and similar bolts shall have a fillet between the head and the shank of bolt at least one-fourth the diameter of the bolt when used in control surfaces or at other locations where they might be subjected to bending or vibration.

§ 4a.316 *Castings.* Castings used in the primary structure shall incorporate the multiplying factor of safety specified in § 4a.209 and shall be of such material and design as to insure the maximum degree of reliability and freedom from defects. The Administrator has the right to prohibit the use of castings where such use is deemed to be unairworthy.

[CAR, May 31, 1938, as amended by Amdt. 75, 5 F. R. 3946]

TIE-RODS AND WIRES

§ 4a.319 *Tie-rods and wires.* The minimum size of tie-rod which may be used in primary structure is No. 6-40. The corresponding minimum allowable size of single-strand hard wire is No. 13 (0.072-inch diameter).

§ 4a.320 *Wire terminals.* The assumed terminal efficiency of single-strand hard wire shall not be greater than 85 percent.

§ 4a.321 *Wire anchorages.* A fitting attached to a wire or cable up to and including the 3,400-pound size shall have at least the rated strength of the wire or cable, and the multiplying factor of safety for fitting (§ 4a.208) is not required in such cases. In the case of fittings to which several tie-rods or wires are attached, this requirement applies separately to each portion of the fitting to which a tie-rod or wire is attached, but does not require simultaneous application of rated wire loads. The end connections of brace wires shall be such as to minimize restraint against bending or vibration.

§ 4a.322 *Counter wire sizes.* (See also §§ 4a.211, 4a.212.) In a wire-braced structure the wire sizes shall be such that any wire can be rigged to at least 10 percent of its rated strength without causing any other wire to be loaded to more than 20 percent of its rated strength. As used here "rated strength" refers to the wire proper, not the terminal.

FLUTTER PREVENTION

§ 4a.326 *General flutter prevention measures.* When he deems it necessary in the interest of safety, the Administrator may require special provisions against flutter. For specific requirements see §§ 4a.264, 4a.336, 4a.449, 4a.450, 4a.451, 4a.452, 4a.465, 4a.466 and 4a.680.

[Amdt. 75, 5 F. R. 3946, as amended by amdt. 04-2, 8 F. R. 13999]

DETAIL DESIGN OF WINGS

§ 4a.329 *External bracing.* When streamline wires are used for external lift bracing they shall be double unless the design complies with the lift-wire-cut condition specified in § 4a.95. (See also § 4a.210.)

§ 4a.330 *Wire-braced monoplanes.* If monoplane wings are externally braced by wires only, the right and left sides of the bracing shall be independent of each other so that an unsymmetrical load from one side will not be carried through the opposite wires before being counteracted, unless the design complies with the following conditions:

(a) The minimum true angle between any external brace wire and a spar is 14 degrees.

(b) The counter (landing) wires are designed to remain in tension at least up to the limit load.

(c) The landing and flying wires are double.

§ 4a.331 *Lift trusses.* Multiple-strand cable shall not be used in lift trusses.

§ 4a.332 *Jury struts.* When clamps are used for attachment of jury struts to lift struts, the design shall be such as to prevent misalignment or local crushing of the lift strut.

§ 4a.333 *Wing beams.* Provisions shall be made to reinforce wing beams against torsional failure, especially at the point of attachment of lift struts, brace wires, and aileron hinge brackets.

§ 4a.334 *Wing beam joints.* Joints in metal beams (except pinned joints) and joints in mid-bays of wood beams shall maintain 100 percent efficiency of the beam with respect to bending, shear, and torsion.

§ 4a.335 *Drag truss.* (a) Fabric-covered wing structures having a cantilever length of overhang such that the ratio of span of overhang to chord at root of overhang is greater than 1.75 shall have a double system of internal drag trussing spaced as far apart as possible, or other means of providing equivalent torsional stiffness. In the former case counter wires shall be of the same size as the drag wires. (See also § 4a.212.)

(b) Multiple-strand cable shall not be used in drag trusses unless such use is substantiated to the satisfaction of the Administrator.

§ 4a.336 *Aileron and flap attachments.* Aileron and flap attachment ribs or brackets shall be rigidly constructed and firmly attached to the main wing structure in order to reduce wing flutter tendencies.

§ 4a.337 *Internally-braced biplanes.* Internally braced biplanes shall be provided with N or I struts to equalize deflections, and the effect of such struts shall be considered in the stress analysis.

§ 4a.338 *Fabric covering.* Fabric covering shall comply with the requirements of § 4a.302 and shall be attached in a manner which will develop the necessary strength, with due consideration for slipstream effects. (See § 4a.252.)

§ 4a.338-1 *Aircraft fabric (CAA rules which apply to § 4a.338).* See §§ 4b.302-1 and 4b.302-2 of this subchapter.

[Supp. 1, 13 F. R. 7725]

§ 4a.339 *Metal-covered wings.* The detail design of such wings shall incorporate suitable provision against buckling or wrinkling of metal covering as specified in §§ 4a.62, 4a.252.

DETAIL DESIGN OF TAIL AND CONTROL SURFACES

§ 4a.445 *Installation.* Movable tail surfaces shall be so installed that there is no interference between the surfaces or their bracing when any one is held in its extreme position and any other is operated through its full angular movement.

§ 4a.446 *Stops.* When an adjustable stabilizer is used, stops shall be provided at the stabilizer to limit its movement, in the event of failure of the adjusting mechanism, to a range equal to the maximum required to balance the airplane.

[CAR, May 31, 1938, as amended by Amdt. 04-2, 8 F. R. 13999]

§ 4a.447 *Elevator trailing edge tab systems.* Elevator trailing edge tab systems shall be equipped with stops which limit the tab travel to values not in excess of those provided for in the structural report. This range of tab movement shall be sufficient to balance the airplane under the conditions specified in § 4a.677.

[Amdt. 5, 4 F. R. 1170]

§ 4a.448 *Hinges.* (a) Hinges of the strap type bearing directly on torque tubes are permissible only in the case of steel torque tubes which have a multiplying factor of safety as specified in § 4a.213. In other cases sleeves of suitable material shall be provided for bearing surfaces.

(b) Clevis pins may be used as hinge pins provided that they are made of material conforming with, or the equivalent of, SAE Specification 2330.

§ 4a.449 *Elevators.* When separate elevators are used they shall be rigidly interconnected.

§ 4a.450 *Dynamic and static balance.* All control surfaces shall be dynamically and statically balanced to the degree necessary to prevent flutter at all speeds up to the design gliding speed.

[Amdt. 5, 4 F. R. 1171]

§ 4a.451 *Wing flaps.* Flaps shall be so installed as not to induce flutter or appreciable buffeting.

§ 4a.452 *Tabs.* The installation of trim and balancing tabs shall be such as to prevent the development of any free motion of the tab. When trailing edge tabs are used to assist in moving the main surface (balancing tabs), the areas and relative movements shall be so proportioned that the main surface is not overbalanced at any time.

[Amdt. 5, 4 F. R. 1171]

DETAIL DESIGN OF CONTROL SYSTEMS

§ 4a.459 *Installation.* All control systems and operating devices shall be so designed and installed as to provide reasonable ease of operation by the crew and so as to preclude the probability of inadvertent operation, jamming, chafing, interference by cargo, passengers, or loose objects, and the slapping of cables against parts of the airplane. All pulleys shall be provided with satisfactory guards.

[Amdt. 56, 5 F. R. 2100]

§ 4a.460 *Stops.* All control systems shall be provided with stops which positively limit the range of motion of the control surfaces. Stops shall be capable of withstanding the loads corresponding to the design conditions for the control system.

§ 4a.461 *Joints.* Bolts with castellated nuts safetied with cotter pins or with an approved type of self-locking nut shall be used throughout the control system, except that the use of clevis pins in standard cable ends, thimbles, and shackles is satisfactory for light airplanes.

[CAR, May 31, 1938, as amended by Amdt. 04-2, 8 F. R. 13999]

§ 4a.462 *Welds.* Welds shall not be employed in control systems to carry tension without reinforcement from rivets or bolts.

§ 4a.463 *Flap controls.* The flap operating mechanism shall be such as to prevent sudden, inadvertent, or automatic opening of the flap at speeds above the design speed for the extended flap conditions. The time required to fully extend or retract flaps shall not be less than 15 seconds, unless it can be demonstrated to the satisfaction of the Administrator that the operation of the flaps in a lesser time does not result in unsatisfactory flight characteristics. Means shall be provided to retain flaps in their fully retracted position and to indicate such position to the pilot.

§ 4a.464-T *Flap controls.* (a) For transport category airplanes, the flap control shall provide means for bringing the flaps from any position within the operating range to any one of three positions, designated as landing, approach, and take-off positions, or to the fully retracted position, by placing the primary flap control in a single setting marked as corresponding to each such flap position, the flaps thereupon moving directly to the desired position without requiring further attention. If any extension of the flaps beyond the landing position is possible, the flap control shall be clearly marked to identify such range of extension.

(b) The landing position, approach position, and take-off position, or any of them, may be made variable with altitude or weight by means of a secondary flap control provided for that purpose. Such a secondary control, if provided, shall operate independently of the primary control and in such manner that when it has been adjusted (for the effect of weight or altitude), the necessary flap position can thereafter be obtained by placing the primary flap control in the desired position. The secondary control shall be so designed and marked as to be readily operable by the crew.

(c) The rate of flap retraction shall be such as to permit compliance with 4a.752-T.

[Amdt. 04-4, 7 F. R. 984]

§ 4a.465 *Tab controls.* (a) Tab controls shall be irreversible and nonflexible, unless the tab is statically balanced about its hinge line. Proper precautions shall be taken against the possibility of inadvertent or abrupt tab operation and operation in the wrong direction.

(b) When adjustable elevator tabs are used for the purpose of trimming the airplane, a tab position indicator shall be installed, and means shall be provided for indicating to the pilot a range of adjustment suitable for safe take-off and the directions of motion of the control for nose-up and nose-down motions of the airplane.

§ 4a.466 *Spring devices.* The use of springs in the control system either as a return mechanism or as an auxiliary mechanism for assisting the pilot (bungee device) is prohibited except under the following conditions:

(a) The airplane shall be satisfactorily maneuverable and controllable and free from flutter under all conditions with and without the use of the spring device.

(b) In all cases the spring mechanism shall be of a type and design satisfactory to the Administrator.

(c) Rubber cord shall not be used for this purpose.

§ 4a.467 *Single-cable controls.* Single-cable controls are prohibited except in special cases in which their use can be proved to be satisfactory.

§ 4a.468 *Control system locks.* When a device is provided for locking a control surface while the aircraft is on the ground or water, compliance with the following requirements shall be shown.

(a) The locking device shall be so installed as to positively prevent taxying the aircraft faster than 20 miles per hour, either intentionally or inadvertently, while the lock is engaged.

(b) Means shall be provided to preclude the possibility of the lock becoming engaged during flights.

§ 4a.469-T *Trim controls.* For transport category airplanes, the trimming devices shall be capable of continued normal operation in spite of the failure of any one connecting or transmitting element in the primary control system. Trim controls shall operate in the plane and with the sense of the motion of the airplane which their operation is intended to produce.

[Amdt. 04-5, 7 F. R. 984]

Detail Design of Landing Gear

§ 4a.475 *Shock absorption.* All landing gear (including tail gear installations) shall be provided with shock-absorbing systems which will permit the airplane to be landed under the conditions specified in §§ 4a.148 (b), 4a.152 without exceeding the ultimate load used in the analysis of any landing gear member. (See § 4a.278 for proof of absorption capacity.) If the design of the shock-absorbing system is such that the above method of specifying the required energy absorption capacity appears to give irrational results, an alternate method will be considered upon presentation of pertinent data.

§ 4a.476 *Shock-absorbing systems.* The shock-absorbing systems employed shall incorporate suitable means for absorbing the shocks developed in taxying or running over rough ground.

§ 4a.477 *Wheels.* Main landing gear wheels shall be of a type or model certificated by the Administrator in accordance with the provisions of Part 15 of this subchapter and shall not be subjected to static loads in excess of those for which they are certificated. Tail wheels may be of any type or model and are not certificated. Nose wheels are subject to special rulings to be made by the Administrator.

§ 4a.478 *Main landing gear wheels.* For the purpose of the regulations in this part main landing gear wheels are considered as those nearest the airplane center of gravity with respect to fore-and-aft location.

§ 4a.479 *Tail and nose wheels.* For the purpose of the regulations in this part, a tail wheel is considered as one which supports the tail of a conventional airplane in the three-point landing attitude. A nose wheel is considered to be a wheel supporting the nose of the airplane when the two main wheels are located behind the center of gravity.

§ 4a.480 *Tires.* A landing gear wheel may be equipped with any make or type of tire, provided that the tire is a proper fit on the rim of the wheel and provided that the tire rating of the Airplane Tire Committee of the Tire and Rim Association is not exceeded.

§ 4a.481 *Tire markings.* When specially constructed tires are used to support an airplane, the wheels shall be plainly and conspicuously marked to that effect. Such markings shall include the make, size, number of plies, and identification marking of the proper tire.

§ 4a.482 *Retracting mechanism.* (a) When retractable landing wheels are used visual means shall be provided for indicating to the pilot, at all times, the position of the wheels. Separate indicators for each wheel are required when each wheel is separately operated unless a single indicator is obviously satisfactory. In addition, landplanes shall be provided with an aural or equally effective indicator which shall function continuously after the throttle is closed until the gear is down and locked.

(b) A positive lock shall be provided for the wheels in the extended position, unless a rugged irreversible mechanism is used.

(c) Manual operation of retractable landing gears shall be provided for.

[Amdt. 5, 4 F. R. 1171]

§ 4a.483-T *Brakes.* Transport category airplanes shall be equipped with brakes certificated in accordance with the provisions of Part 15 of this subchapter, for the maximum certificated landing weight at sea level and the power-off stalling speed, V_{s_0}, as defined in § 4a.739-T. The brake system for such airplanes shall be so designed and constructed that in the event of a single failure in any connecting or transmitting element in the brake system, or the loss of any single source of hydraulic or other brake operating energy supply, it shall be possible, as shown by suitable test or other data, to bring the airplane to rest under the conditions specified in § 4a.750-T with a mean negative acceleration during the land roll of at least 50 percent of that obtained in determining the landing distance under that section.

[Amdt. 04-6, 7 F. R. 985 as amended by Amdt. 04-2, 8 F. R. 13999]

Hulls and Floats

§ 4a.488 *Hulls and floats.* (See also §§ 4a.497 through 4a.513.)

§ 4a.489 *Buoyancy (main seaplane floats).* (a) Main seaplane floats shall have a buoyancy in excess of that required to support the gross weight of the airplane in fresh water as follows:

(1) 80 percent in the case of single floats,

(2) 90 percent in the case of double floats.

(b) Main seaplane floats for use on aircraft of 2,500 pounds or more maximum authorized weight shall contain at least five watertight compartments of approximately equal volume. Main seaplane floats for use on aircraft of less than 2,500 pounds maximum authorized weight shall contain at least four such compartments.

§ 4a.490 *Buoyancy (boat seaplanes).* The hulls of boat seaplanes and amphibians shall be divided into watertight compartments in accordance with the following requirements:

(a) In aircraft of 5,000 pounds maximum authorized weight or more the compartments shall be so arranged that, with any two adjacent compartments flooded, the hull and auxiliary floats (and tires, if used) will retain sufficient buoyancy to support the gross weight of the aircraft in fresh water.

(b) In aircraft of 1,500 to 5,000 pounds maximum authorized weight the compartments shall be so arranged that, with any one compartment flooded, the hull and auxiliary floats (and tires, if used) will retain sufficient buoyancy to support the maximum authorized weight of the aircraft in fresh water.

(c) In aircraft of less than 1,500 pounds maximum authorized weight watertight subdivision of the hull is not required.

(d) Bulkheads may have watertight doors for the purpose of communication between compartments.

§ 4a.491 *Water stability.* Auxiliary floats shall be so arranged that when completely submerged in fresh water, they will provide a righting moment which is at least 1.5 times the upsetting moment caused by the aircraft being tilted. A greater degree of stability may be required in the case of large flying boats, depending on the height of the center of gravity above the water level, the area and location of wings and tail surfaces, and other considerations.

§ 4a.492 *Float design.* In designing the bow portion of floats and hulls suitable provision shall be made for the effects of striking floating objects.

Fuselage and Cabins

§ 4a.497 *Provision for turn-over.* The fuselage and cabins shall be designed to protect the passengers and crew in the event of a complete turn-over and adequate provision shall be made to permit egress of passengers and crew in such event. The requirements of this section may be suitably modified when the possibility of a complete turn-over in landing is remote.

[Amdt. 5, 4 F. R. 1171]

§ 4a.498 *External door.* Closed cabins on all aircraft carrying passengers shall be provided with at least one adequate and easily accessible external door.

§ 4a.499 *Location of passenger door.* No passenger door shall be located in the plane of rotation of an inboard propeller, nor within 5 degrees thereof as measured from the propeller hub.

[Amdt. 5, 4 F. R. 1171]

§ 4a.500 *Exits.* Closed cabins on air craft carrying more than 5 persons shall be provided with emergency exits, in addition to the one external door required by § 4a.493, consisting of movable windows or panels or of additional external doors which provide a clear and unobstructed opening, the minimum dimensions of which shall be such that a 19-inch by 26-inch ellipse may be completely inscribed therein. The location and the method of operation of emergency exits shall be approved by the Administrator. If the pilot is in a compartment separate from the cabin, passage through such compartment shall not be considered as an emergency exit for the passengers. The number of emergency exits required is as follows:

(a) Aircraft with a total seating capacity of more than 5 persons, but not in excess of 15, shall be provided with at least one emergency exit or one suitable door in addition to the main door specified in § 4a.498. This emergency exit, or second door, shall be on the opposite side of the cabin from the main door. If desired, an additional emergency exit may be provided in the top of the cabin, but such an installation shall not obviate the necessity for an exit on each side.

(b) Aircraft with a seating capacity of more than 15 persons shall be provided with an additional emergency exit or door either in the top or side of the cabin for every additional 7 persons or fraction thereof above 15, except that not more than 4 exits, including doors, will be required if the arrangement and dimensions are suitable for the purpose intended.

[CAR, May 31, 1938, as amended by Amdt. 48, 5 F. R. 1836]

PILOT COMPARTMENT

§ 4a.501 *Construction.* The pilot compartment shall be so constructed as to afford suitable ventilation and adequate vision to the pilot under normal flying conditions. In cabin aircraft the windows shall be so arranged that they may be readily cleaned or easily opened in flight to provide forward vision for the pilot. The ventilation requirements of § 4a.510 shall also apply to the pilot compartment.

§ 4a.502 *Location.* The pilot and the primary control units, excluding cables and control rods, shall be so located with respect to the propellers that no portion of the pilot or controls lies in the region between the plane of rotation of any propeller and the surface generated by a line passing through the center of the propeller hub and making an angle of 5 degrees forward or aft of the plane of rotation of the propeller.

§ 4a.503 *Identification plate.* A metal identification plate shall be permanently affixed in a visible location in the pilot compartment of each airplane. This plate shall contain the manufacturer's name, the date of manufacture, the manufacturer's serial number, and the model designation. The manufacturer shall specify the fuel capacity of each fuel tank on the manufacturer's identification plate, or on or adjacent to the fuel shut-off valves in the pilot compartment.

§ 4a.504 *Operation information and limitations.* Means shall be provided by which the operating personnel is suitably informed of all operation information and limitations deemed necessary by the Administrator.

[Amdt. 48, 5 F. R. 1836, as amended by Amdt. 75, 5 F. R. 3946]

§ 4a.505 *Windows and windshields.* The windows and windshields of the pilot compartment in airplanes certificated for air transportation service shall be so arranged as to provide satisfactory forward vision and protection under all conditions and, to accomplish this, particular attention shall be paid to the following detail requirements:

(a) Sufficient data specifying the windshield material, number of laminations, binder if any, size and shape of panes, angle of panes to flight path, and method and rigidity of mounting, shall be forwarded to the Administrator for rulings as to the acceptability of the windshield from the standpoint of strength.

(b) Windshields shall be so installed that they can be easily opened in flight and shall be so arranged that the air stream and snow or rain are deflected across the opening, or to provide equivalent results.

(c) The pilot compartment shall be so constructed and arranged as to prevent glare or reflections which would interfere with the vision of either pilot, particularly while flying at night. The aircraft will be flown by a representative of the Administrator during hours of darkness to determine compliance with this provision.

§ 4a.506 *Leakage.* The pilot compartment in airplanes certificated for air transportation service shall be so constructed as to prevent any leakage into it when the airplane is flying in rain or snow.

§ 4a.507 *Seats.* When a second pilot is required (§ 61.121 of this subchapter) two seats shall be installed side by side in the pilot compartment of airplanes certificated for air transportation service from either of which the airplane shall be fully and readily controllable. If any difference exists as to convenience of the instruments and controls necessary for safe flight such differenee should favor the left-hand seat. The left-hand seat shall be known as the first pilot's seat and the right-hand one as the second pilot's seat.

§ 4a.508 *Navigation instruments.* The navigation instruments for use by the pilot in airplanes certificated for air transportation service shall be so installed as to be easily visible to him with the minimum practicable deviation from his normal position and line of vision when he is looking out and forward along the flight path and they shall also be visible to the second pilot.

§ 4a.509 *Opening between pilot compartment and passengers' cabin.* All airplanes certificated for air transportation service shall be provided with a door or an adequate openable window between the pilot compartment and the passenger cabin. When a door is provided it shall be equipped with a locking means which shall prevent passengers from opening such door while in flight.

PASSENGER AND BAGGAGE COMPARTMENTS

§ 4a.510 *Passenger compartments.* A suitable ventilation system shall be provided which will preclude the presence of fuel fumes and dangerous traces of carbon monoxide in each passenger compartment.

§ 4a.511 *Passenger chairs.* Seats or chairs for passengers shall be securely fastened in place in both open and closed airplanes, whether or not the safety belt load is transmitted through the seat.

CROSS REFERENCES: For safety belt requirements, see Part 15 of this subchapter and § 4a.193.

§ 4a.512 *Baggage compartments.* Each baggage and mail compartment shall bear a placard stating the maximum allowable weight of contents, as determined by the structural strength of the compartment (§ 4a.194) and by flight test (§ 4a.725). Suitable means shall be provided to prevent the contents of mail and baggage compartments from shifting.

REINFORCEMENT NEAR PROPELLERS

§ 4a.513 *Reinforcement near propellers.* Surfaces near propeller tips shall be suitably stiffened against vibration and effects of ice thrown from the propeller.

CROSS REFERENCE: For clearance requirements, see § 4a.599.

SUBPART F—EQUIPMENT

SOURCE: §§ 4a.523 to 4a.581 contained in Civil Air Regulations, May 31, 1938, as amended by Amendment 75, 5 F. R. 3946; except as noted following sections affected.

§ 4a.523 *General.* The equipment required shall be dependent upon the type of operation for which certification is to be made. The requirements specified in this subpart shall be the basic equipment requirements and such additional equipment as may be specified in other sections of the Civil Air Regulations for specific special cases shall be supplemental hereto unless otherwise specified.

§ 4a.524 *Requirements.* Each item of equipment specified in the Civil Air Regulations shall be of a type and design satisfactory to the Administrator, shall be properly installed, and shall function to the satisfaction of the Administrator. Items of equipment for which certification is required shall have been certificated in accordance with the provisions of Part 15 of this subchapter or previous regulations.

§ 4a.525 *Life preserver or flotation device.* An approved life preserver or flotation device is one approved by the Administrator for such usage on sea-going vessels.

§ 4a.525-1 *Life rafts and life preservers (CAA rules which apply to § 4a.525).* See §§ 4b.811-1 and 4b.811-2 of this subchapter.

[Supp. 1, 13 F. R. 7725]

§ 4a.526 *Fire extinguishing apparatus.* Fire extinguishing apparatus approved by the Underwriters Laboratories is considered to be of an approved type.

NON-AIR CARRIER (NAC) AIRPLANES

§ 4a.531 *Non-air carrier (NAC) airplanes.* Airplanes which are certificated as non-air carriers shall have at least the equipment set forth in §§ 4a.532–4a.537.

[CAR, May 31, 1938, as amended by Reg. 601-A-1, 3 F. R. 2055]

§ 4a.531-2 *Life rafts and life preservers (CAA rules which apply to § 4a.531).* See §§ 4b.811-1 and 4b.811-2 of this subchapter.

[Supp. 1, 13 F. R. 7725]

§ 4a.532 *NAC landplanes; visual contact day flying (within 100 miles of a fixed base).* (a) One air-speed indicator.

CROSS REFERENCE: For installation requirements, see § 4a.559.

(b) One altimeter.
(c) A tachometer for each engine.
(d) An oil-pressure gauge when an oil-pressure system is employed.
(e) A water thermometer for each water-cooled engine.
(f) An oil thermometer for each air-cooled engine.
(g) A manifold-pressure gauge, or equivalent, for each altitude engine.
(h) A fuel quantity gauge. (See § 4a.609 for requirements.)
(i) Certificated safety belts for all passengers and members of the crew.

CROSS REFERENCES: For belt requirements, see Part 15 of this subchapter. For installation requirements, see § 4a.565.

(j) A portable fire extinguisher, which extinguisher shall be of an approved type, which shall have a minimum capacity, if carbon tetrachloride, of 1 quart, or, if carbon dioxide, of 2 pounds, or, if other, of equivalent effectiveness; except that any extinguisher of not less than half the above capacity may be used in an airplane equipped with an engine whose maximum rating is 40 horsepower or less. (See § 4a.566 for installation requirements.)
(k) Landing gear position indicator for retractable main landing gear. (See § 4a.482 for requirements.)
(l) A device for measuring or indicating the amount of oil in the tanks. (See § 4a.624 for requirements.)
(m) A first-aid kit.
(n) A logbook for the airplane and one for each engine. (See Part 1 of this subchapter for requirements.)
(o) Rigging information for airplanes with wire-braced wings, either in the form of a sketch or listed data, which shall include sufficient information to permit proper rigging.

[CAR, May 31, 1938, as amended by Amdt. 5, 4 F. R. 1171, Amdt. 116, 6 F. R. 2870]

§ 4a.532-1 *Portable water-solution type fire extinguishers (CAA rules which apply to § 4a.532(j)).* See § 4b.448-4 of this subchapter.

[Supp. 3, 14 F. R. 3196]

§ 4a.533 *NAC landplanes; visual contact day flying (unlimited distance).* Airplanes of this category shall have the equipment specified in § 4a.532 and, in addition, there shall be installed:

(a) A magnetic compass.

CROSS REFERENCE: For installation requirements, see § 4a.562.

§ 4a.534 *NAC landplanes; visual contact night flying.* Airplanes of this category shall have the equipment specified in § 4a.533 and, in addition, there shall be installed:

(a) A set of certificated standard forward position lights in combination with a certificated tail light.

CROSS REFERENCES: For light requirements, see Part 15 of this subchapter. For installation requirements, see § 4a.578.

(b) Two electric landing lights if the aircraft is operated for hire: *Provided, however,* That only one such landing light shall be required for any airplane certificated for a weight of less than 1,500 pounds. (See § 4a.576 for installation requirements.)
(c) Certificated landing flares as follows, if the aircraft is operated for hire beyond an area within a circle with a radius of 3 miles drawn from the center of the airport of take-off (see Part 15 of this subchapter for flare requirements and § 4a.568 for installation requirements):
(1) Airplanes of 3,500 pounds maximum authorized weight or less—five Class 3 flares or three Class 2 flares.
(2) Airplanes of between 3,500 pounds and 5,000 pounds maximum authorized weight—four Class 2 flares.
(3) Airplanes of 5,000 pounds maximum authorized weight or more—two Class 1 flares or three Class 2 flares and one Class 1 flare.
(4) If desired, airplanes of less than 5,000 pounds maximum authorized weight may carry the flare equipment specified for heavier airplanes.
(d) A storage battery suitable as a source of energy supply for such lights and radio as are installed.

CROSS REFERENCE: For installation requirements, see § 4a.571.

(e) Radio equipment, if the aircraft is operated in a control zone (§ 60.13 of this subchapter), as follows: A radio range and weather broadcast receiver operating within the frequency range of 200 to 400 kilocycles. Under normal atmospheric conditions this receiver must be capable of receiving with a range of 100 miles intelligence emanated from a radio range or weather broadcast station the equivalent of a simultaneous Adcock range with scheduled broadcast installation.
(f) A set of spare fuses.

CROSS REFERENCE: For installation requirements, see § 4a.572.

[CAR, May 31, 1938, as amended by Amdt. 5, 4 F. R. 1171]

§ 4a.535 *NAC landplanes; instrument day flying.* Airplanes of this category shall have the equipment specified in § 4a.533 and, in addition, there shall be installed:

(a) Radio equipment: Same as § 4a.534 (e), whether the aircraft is operated for hire or not, and, in addition, a radio transmitter operated on 3105 kilocycles with a power output sufficient to establish communication at a distance at least 100 miles under normal atmospheric conditions. Additional frequencies may be employed subject to approval of the Federal Communications Commission.
(b) A gyroscopic rate-of-turn indicator.
(c) A bank indicator. (The rate-of-turn indicator may be combined in the bank indicator if desired.)
(d) A sensitive altimeter which shall be adjustable for changes in barometric pressure and compensated for changes in temperature.
(e) A clock with a sweep second hand.
(f) A storage battery suitable as a source of energy supply for the radio equipment installed.

CROSS REFERENCE: For installation requirements, see §§ 4a.571, 4a.573.

(g) A generator.
(h) A set of spare fuses.

CROSS REFERENCE: For installation requirements, see § 4a.572.

(i) A rate-of-climb indicator.

§ 4a.535-1 *Air-speed indicators, turn-and-bank indicators, direction indicators, climb indicators, and altimeters (CAA rules which apply to § 4a.531).* See §§ 4b.691-1, 4b.691-2, 4b.691-6, 4b.691-7, and 4b.691-8 of this subchapter.

[Supp. 1, 13 F. R. 7725]

§ 4a.536 *NAC landplanes; instrument night flying.* Airplanes of this category shall have the equipment specified in §§ 4a.534, 4a.535 combined. The storage battery shall be suitable as a source of energy supply for both the radio equipment and the lights.

§ 4a.537 *NAC seaplanes and amphibians.* The equipment requirements for seaplanes and amphibians shall be the same as specified for landplanes (§§ 4a.532–4a.536) except that seaplanes and amphibians shall not be certificated for operation over water out of sight of land unless they have at least the equipment specified in § 4a.533, and except that all certificated seaplanes and amphibians shall also have an approved life preserver or flotation device for each person for whom there is a seat, and except that all seaplanes and amphibians certificated for night operation shall also have a white anchor light.

§ 4a.537-1 *Life rafts and life preservers (CAA rules which apply to § 4a.537).* See §§ 4b.811-1 and 4b.811-2 of this subchapter.

[Supp. 1, 13 F. R. 7725]

CROSS REFERENCE: For installation requirements, see § 4a.575.

AIR CARRIER AIRPLANES; PASSENGER (ACP)

§ 4a.547 *Air carrier airplanes; passengers (ACP).* Airplanes certificated for use by an air carrier in passenger service shall have installed at least the equipment set forth in §§ 4a.548–4a.552.

[CAR, May 31, 1938, as amended by No. 601-A-1, 3 F. R. 2055]

§ 4a.548 *ACP landplanes; visual contact day flying.* The same as specified in § 4a.533 and, in addition, the following:

(a) An electrically heated pitot tube, or equivalent, for the air-speed indicator.

(b) One additional portable fire extinguisher of the type specified in § 4a.532 (j). (See § 4a.566 for installation requirements.)

(c) Fixed fire extinguishing apparatus of an approved type for each engine compartment.

(d) Type certificated radio equipment as specified in Part 40 of this subchapter.

(e) A set of spare fuses. (See § 4a.572 for installation requirements.)

(f) A rate-of-climb indicator.

(g) A storage battery: Same as § 4a.535 (f).

(h) A means for providing, without continuous manual operation, vision through the windshield adequate for executing take-offs and landings in rain.

[Amdt. 129, 7 F. R. 4691, amended by Amdt. 04-15, 7 F. R. 6240]

§ 4a.549 *ACP landplanes; visual contact night flying.* The same as specified in § 4a.548 and, in addition, the following:

(a) A set of certificated air carrier airplane position lights. The forward lights may be air carrier forward position lights or a combination of standard forward position lights and a set of auxiliary forward position lights. (See Part 15 of this subchapter for light requirements and § 4a.578 for installation requirements.)

(b) A storage battery of sufficient capacity for such lights and radio as are installed.

CROSS REFERENCE: For installation requirements, see §§ 4a.571, 4a.573.

(c) Two electric landing lights.

CROSS REFERENCE: For installation requirements, see § 4a.576.

(d) Certificated landing flares as follows: two Class 1 flares or three Class 2 flares and one Class 1 flare.

CROSS REFERENCES: For flare requirements, see Part 15 of this subchapter. For installation requirements, see § 4a.568.

(e) Instrument lights.

CROSS REFERENCE: For installation requirements, see § 4a.577.

(f) Cabin lights in all passenger cabins and compartments.

(g) A generator. (See § 4a.573 for requirements.)

(h) Radio equipment same as § 40.61.

[CAR, May 31, 1938, as amended by Amdt. 04-9, 7 F. R. 1709, Amdt. 04-2, 8 F. R. 13999]

§ 4a.550 *ACP landplanes; instrument day flying.* The same as specified in § 4a.548 except § 4a.548 (b) and, in addition, the following:

(a) A gyroscopic rate-of-turn indicator combined with a bank indicator.

(b) A gyroscopic instrument showing bank and pitch.

(c) A gyroscopic direction finder.

(d) Two sensitive-type altimeters, both of which shall be adjustable for changes in barometric pressure and compensated for changes in temperatures: *Provided*, That aircraft in use on or before January 1, 1939, and thereafter replacements and additions of aircraft of the same make and model may, for purposes of standardization, be deemed to have met this requirement, if there are installed in each such aircraft one sensitive type altimeter and one standard type altimeter, provided each is adjustable for changes in barometric pressure and compensated for changes in temperature.

(e) A free air thermometer of the distance type with an indicating dial in the cockpit.

(f) A clock with a sweep second hand.

(g) A vacuum gauge, installed in the lines leading to instruments in paragraphs (a), (b) and (c) of this section.

(h) Type certificated radio equipment as specified in Part 40 of this subchapter.

(i) Means shall be provided to indicate icing conditions, or the probability thereof, in the carburetor if the de-icing device specified in § 4a.616 requires the manual manipulation of controls.

(j) A storage battery suitable as a source of energy supply for the radio equipment installed.

CROSS REFERENCE: For installation requirements, see §§ 4a.571, 4a.573.

(k) A generator.

CROSS REFERENCE: For installation requirements, see § 4a.573.

[CAR, May 31, 1938, as amended by Amdt. 5, 4 F. R. 1171, Amdt. 85, 6 F. R. 5145]

§ 4a.550-1 *Air-speed indicators, turn-and-bank indicators, bank-and-pitch indicators, direction indicators, climb indicators, altimeters, and air-speed tubes (CAA rules which apply to § 4a.550.)* See §§ 4b.691-1-4b.691-5, 4b.691-7, 4b.691-8, and 4b.691-10 of this subchapter.

[Supp. 1, 13 F. R. 7725]

§ 4a.551 *ACP landplanes; instrument night flying.* The same as specified in §§ 4a.549 and 4a.550 combined. The storage battery, in this case, shall be of sufficient capacity for all radio equipment and all lights installed.

§ 4a.552 *ACP seaplanes and amphibians.* The same as specified for landplanes. (§§ 4a.548-4a.551) and including the life preservers specified in § 4a.537, except that when certificated for night operation they shall also have installed the anchor light specified in § 4a.537.

INSTALLATION REQUIREMENTS

§ 4a.557 *Installation requirements.* The regulations in §§ 4a.558-4a.581 apply to the installation of specific items of equipment and are additional to the regulations of § 4a.523.

INSTRUMENT INSTALLATION

§ 4a.558 *Instruments.* The regulations in §§ 4a.559-4a.564 shall apply to the installation of instruments when such instruments are required by the regulations in this part.

§ 4a.559 *Air-speed indicator.* This instrument shall be so installed as to indicate true air speed at sea level with the maximum practicable accuracy, but the instrument error shall not be more than plus or minus 3 percent, except that it need not be less than plus or minus 5 miles per hour, at the level flight speed corresponding to the design power (§ 4a.38 (b)), at V_L (§ 4a.40 (c)), or at the maximum attainable level flight speed, whichever is lowest.

[Amdt. 5, 4 F. R. 1171]

§ 4a.560 *Power-plant instruments and controls.* See §§ 4a.642, 4a.643.

§ 4a.561 *Fuel quantity gauge.* See § 4a.609.

§ 4a.562 *Magnetic compass.* This instrument shall be properly damped and compensated and shall be located where it is least affected by electrical disturbances and magnetic influences.

§ 4a.563 *Navigational instruments.* Navigational instruments for use by the pilot shall be so installed as to be easily visible to him with the minimum practicable deviation from his normal position and line of vision when he is looking out and forward along the flight path, and they shall also be visible to the second pilot.

§ 4a.564 *Gyroscopic instruments.* All gyroscopic instruments shall derive their energy from engine-driven pumps or from auxiliary power units. Each source of energy supply and its attendant complete installation shall comply with the instrument manufacturer's recommendations for satisfactory instrument operation. On multiengine aircraft each instrument shall have two separate sources of energy, either one of which shall be capable of carrying the required load. Engine-driven pumps, when used, shall be on separate engines. The installation shall be such that failure of one source of energy or breakage of one line will not interfere with proper functioning of the instruments by means of the other source.

SAFETY EQUIPMENT INSTALLATION

§ 4a.565 *Safety belts.* Safety belts shall be so attached that no part of the attachment will fail at a load lower than that specified in § 4a.193.

§ 4a.566 *Fire extinguishers.* The portable fire extinguisher specified in § 4a.532 (j) shall be so installed as to be accessible to the passengers. The two portable fire extinguishers specified in § 4a.548 shall be so installed that one is readily available to the crew and the other is near the main external cabin door where it shall be readily available to passengers and ground personnel.

§ 4a.567 *Safety belt signal.* When a signal or sign is used to indicate to passengers the times that seat belts should be fastened, such signal or sign shall be located in a conspicuous place and so arranged that it can be operated from the seat of either pilot.

[Amdt. 129, 7 F. R. 4691]

§ 4a.568 *Landing flares.* Landing flares shall be releasable from the pilot compartment. Structural provision shall be made for the recoil loads.

§ 4a.569 *De-icers.* Positive means shall be provided for the deflation of all wing boots.

ELECTRICAL EQUIPMENT INSTALLATION

§ 4a.570 *General.* Electrical equipment shall be installed in accordance with accepted practice and suitably protected from fuel, oil, water, and other detrimental substances. Adequate clearance shall be provided between wiring and fuel and oil tanks, fuel and oil lines, carburetors, exhaust piping, and moving parts.

[Amdt. 48, 4 F. R. 1836]

§ 4a.571 *Battery.* Batteries shall be easily accessible and adequately isolated from fuel, oil, and ignition systems. Adjacent parts of the aircraft structure shall be protected with a suitable acid-proof paint if the battery contains acid or other corrosive substance and is not completely enclosed. If the battery is completely enclosed, suitable ventilation shall be provided. All batteries shall be so installed that spilled liquid will be suitably drained or absorbed without coming in contact with the airplane structure.

§ 4a.572 *Fuses.* Fuses shall be so located that they can readily be replaced in flight. They shall break the current in a generating system at a sufficiently small current flow adequately to protect the lights, radio equipment, and other parts of the circuit.

§ 4a.573 *Generator.* When a generator is specified it shall have sufficient capacity to carry the entire running load. Such generator shall be engine-driven unless an approved equivalent system is provided. Auxiliary power units will be approved in lieu of batteries and engine-driven generators, provided that they are at least two in number and that the supply system is capable of carrying the entire running load with any one unit out of action.

§ 4a.574 *Running load.* The running load shall be defined as the electric consumption of all lights, radio equipment, and other electrical devices, except those which are designed only for occasional intermittent use. Examples of devices regarded as intermittent are radio broadcasting equipment, landing lights, and electrically operated landing gears and wing flaps. Radio range signal receivers and all other lights are considered a part of the constant load.

§ 4a.575 *Anchor lights.* The anchor light specified for seaplanes and amphibians shall be so mounted and installed that, when the airplane is moored or drifting on the water, it will show a white light visible for at least 2 miles at night under clear atmospheric conditions.

[Amdt. 48, 4 F. R. 1836]

§ 4a.576 *Landing lights.* Electric landing lights shall be so installed on multiengine aircraft that at least one shall be not less than 10 feet to the right or left of the first pilot's seat and beyond the swept disk of the outermost propeller. On single-engine aircraft such lights shall be so installed that no visible portion of the swept disk of the propeller, if of the tractor type, is illuminated thereby. Individual switches for each light shall be provided in the pilot compartment.

[Amdt. 5, 4 F. R. 1171]

§ 4a.577 *Instrument lights.* Instrument lights shall be so installed as to provide sufficient illumination to make all flight instruments easily readable and shall be equipped with rheostat control for dimming unless it can be shown that a nondimming light is satisfactory.

§ 4a.578 *Position lights.* Position lights shall be installed so that, with the airplane in normal flying position, the forward red position light is displayed on the left side and the forward green position light on the right side, each showing unbroken light between two vertical planes whose dihedral angle is 110 degrees when measured to the left and right, respectively, of the airplane from dead ahead. Such forward position lights shall be spaced laterally as far apart as practicable. One rear position light shall be installed on the airplane at the rear and as far aft as possible and shall show a light visible aft throughout a dihedral angle of 140 degrees bisected by a vertical plane through the longitudinal axis of the airplane. Such light shall emit (a) in the case of a non-air carrier airplane, either a continuous white light as specified in § 15.20 (b) (5) of this subchapter, or alternate red and white flashes as specified in § 15.20 (b) (6) of this subchapter, and (b) in the case of an air carrier airplane, alternate red and white flashes as specified in § 15.20 (b) (6) of this subchapter. In lieu of such a single flashing rear position light, an airplane may carry two rear position lights, one red and one white, spaced as closely as possible to each other and in combination emitting the red and white flashes specified in § 15.20 (b) (6) of this subchapter.

[Amdt. 04-10, 7 F. R. 1709 as amended by Amdt. 04-1, 9 F. R. 2772, Amdt. 04-2, 9 F. R. 11462]

§ 4a.578-1 *Position light flashers (CAA rules which apply to § 4a.578).* See § 4b.776-1 of this subchapter.

[Supp. 3, 14 F. R. 3196]

§ 4a.579 *Master switch.* Electrical installations shall incorporate a master switch easily accessible to a member of the crew.

MISCELLANEOUS EQUIPMENT INSTALLATION

§ 4a.580 *Seats.* Seats or chairs, even though adjustable, in open or closed airplanes, shall be securely fastened in place whether or not the safety belt load is transmitted through the seat.

§ 4a.581 *Accessories.* Engine-driven accessories on multiengine aircraft shall be distributed among two or more engines.

SUBPART G—POWER-PLANT INSTALLATION

ENGINES

SOURCE: §§ 4a.591 to 4a.661 contained in Civil Air Regulations May 31, 1938, as amended by Amendment 75, 5 F. R. 3946, except as noted following sections affected.

§ 4a.591 *Engines.* Engines shall be of a type and design which has been type certificated, or found eligible for use in certificated aircraft, in accordance with the requirements of Part 13 of this subchapter or shall have been approved as airworthy in accordance with previous regulations.

[Amdt. 116, 6 F. R. 2870]

PROPELLERS

§ 4a.597 *Propellers.* Propellers shall be of a type and design which has been certificated as airworthy in accordance with the requirements of Part 14 of this subchapter or shall have been approved as airworthy in accordance with previous regulations, except that wood propellers of a conventional type for use in light airplanes need not be certificated. In certain cases maximum engine bore limitations are also assigned to propellers. Propellers may be used on any engine provided that the certified power ratings, speed ratings, and bore of the engine are not in excess of the limitations of the propeller as certificated, and further provided that the vibration characteristics of the combination are satisfactory to the Administrator.

[CAR, May 31, 1938, as amended by Amdt. 04-2, 8 F. R. 13999]

§ 4a.598 *Controllable pitch.* The control mechanism shall be designed and equipped with a positive stop which shall limit the minimum pitch so that the take-off crankshaft speed for which the aircraft is certificated is not exceeded during take-off with take-off power unless it is necessary to so locate the stop that a higher crankshaft speed may be used in an emergency. The means provided for controlling the pitch shall be so arranged as to minimize the attention required from a pilot to prevent the engines from exceeding their crankshaft speed limitations under any flight condition.

§ 4a.599 *Propeller clearance.* Propellers shall have a minimum ground clearance of 9 inches when the airplane is in a horizontal position with the landing gear deflected as it would be under the maximum authorized weight of the airplane. Propellers on seaplanes shall clear the water by at least 18 inches when the seaplane is at rest under the maximum authorized load condition. A clearance of at least 1 inch shall be provided between the tips of the propellers and any part of the structure.

FUEL SYSTEMS

§ 4a.605 *Capacity and feed.* The fuel capacity shall be at least 0.15 gallons per maximum (except take-off) horsepower for which the airplane is certificated. Air-pressure fuel systems shall not be used. Only straight gravity feed or mechanical pumping of fuel is permitted. The system shall be so arranged that the entire fuel supply may be utilized in the steepest climb and at the best gliding angle and so that the feed ports will not be uncovered during normal maneuvers involving moderate rolling or side slipping. The system shall also feed fuel promptly after one tank has run dry and another tank is turned on. If a mechanical pump is used, an emergency hand pump of equal capacity shall be installed and available for immediate use in case of a pump failure during take-off. Hand pumps of suitable capacity may also be used for pumping fuel from an auxiliary tank to a main fuel tank.

§ 4a.606 *Tank installation.* No fuel tank shall be placed closer to an engine than the remote side of a fire wall. At least one-half inch clear air space shall be allowed between the tank and the fire wall. Spaces adjacent to the surfaces of the tank shall be ventilated so that fumes cannot accumulate or reach the crew or passengers in case of leakage. If two or more tanks have their outlets interconnected they shall be considered as one tank and the air space in the tanks shall also be interconnected to prevent differences in pressure at the air vents of each tank of sufficient magnitude to cause fuel flow between tanks. Mechanical pump systems shall not feed from more than one tank at a time except by special ruling from the Administrator.

§ 4a.607 *Tank construction.* Each fuel tank shall be provided with either a sump and drain located at the point which is lowest when the airplane is in a normal position on the ground or outlets at the bottom of the tank provided with large mesh finger strainers. If a sump is provided, the main fuel supply shall not be drawn from the bottom of this sump. If no sump is provided, the system drain shall be controllable from the pilot compartment and shall act as a tank drain. Each tank shall be suitably vented from the top portion of the air space. Such air vents shall be so arranged as to minimize the possibility of stoppage by dirt or ice formation. When large fuel tanks are used, the size of the vent tubes should be proportioned so as to permit rapid changes in internal air pressure to occur and thereby prevent collapse of the tanks in a steep glide or dive. Tanks of 10 gallons or more capacity shall be provided with internal baffles, unless suitable external support is provided to resist surging.

§ 4a.608 *Tank strength.* Fuel tanks shall be capable of withstanding an internal test pressure of 3½ pounds per square inch without failure or leakage. Fuel tanks of large capacity which have a maximum fuel depth greater than 2 feet shall be investigated for the pressure developed during the maximum limit acceleration with full tanks. Tanks shall be so designed, and the rivets or welds so located, as to resist vibration failures or leakage.

§ 4a.609 *Gauge.* A satisfactory gauge shall be so installed on all airplanes as to readily indicate to a pilot or flight mechanic the quantity of fuel in each tank while in flight. When two or more tanks are closely interconnected and vented, and it is impossible to feed from each one separately, only one fuel-level gauge need be installed. If a glass gauge is used, it shall be suitably protected against breakage.

§ 4a.610 *Lines and fittings.* All fuel lines and fittings shall be of sufficient size so that under the pressure of normal operation the flow is not less than double the normal flow required for take-off engine power. A test for proof of compliance with this requirement shall be made. All fuel lines shall be so supported as to prevent excessive vibration and should be located so no structural loads can be applied. Bends of small radius and vertical humps in the lines shall be avoided. Copper fuel lines which have been bent shall be annealed before installation. Parts of the fuel system attached to the engine and to the primary structure of the airplane shall be flexibly connected thereto. Flexible hose connections and fuel lines shall have metal liners or the equivalent. Fittings shall be of a type satisfactory to the Administrator.

§ 4a.611 *Strainers.* One or more strainers of adequate size and design, incorporating a suitable sediment trap and drain, shall be provided in the fuel line between the tank and the carburetor and shall be installed in an accessible position. The screen shall be easily removable for cleaning.

§ 4a.612 *Valves.* One or more positive and quick-acting valves that will shut off all fuel to each engine shall be within easy reach of the first pilot and the second pilot or of the flight mechanic. In the case of airplanes employing more than one source of fuel supply, suitable provision shall be made for independent feeding from each source.

§ 4a.613 *Dump valves.* When fuel tanks are equipped with dump valves, the operating mechanism for such valves shall be within convenient reach of the first pilot and the second pilot or of the flight mechanic. Dump valves shall be so installed as to provide for safe and rapid discharge of fuel.

§ 4a.614 *Drains.* One or more accessible drains shall be provided at the lowest point on the fuel systems to completely drain all parts of each system when the airplane is in its normal position on level ground. Such drains shall discharge clear of all parts of the airplane and shall be equipped with suitable safety locks to prevent accidental opening.

MISCELLANEOUS FUEL SYSTEM REQUIREMENTS

§ 4a.615 *Filler openings.* All filler openings in the fuel system shall be plainly marked with the capacity and the word "fuel". Provision shall be made to prevent any overflow from entering the wing or fuselage.

§ 4a.616 *Prevention of ice formation.* An adequate means shall be provided for preventing the formation of ice in the engine carburetors (see also § 4a.550 (i).

[Amdt. 5, 4 F. R. 1171]

LUBRICATION SYSTEMS

§ 4a.621 *General.* Each engine shall have an independent oil supply. The oil capacity of the system shall be at least 1 gallon for every 25 gallons of fuel but shall not be less than 1 gallon for each 75 maximum (except take-off) rated horsepower of the engine or engines. A special ruling concerning the capacity will be made by the Administrator when oil may be transferred between engines in flight or when a suitable reserve is provided. The suitability of the lubrication system shall be demonstrated in flight tests in which engine temperature measurements are obtained. The system shall provide the engine with an ample quantity of oil at a temperature suitable for satisfactory engine operation.

[Amdt. 04-1, 7 F. R. 7933]

§ 4a.622 *Tank installation.* Oil tanks shall be suitably vented and shall be provided with an expansion space which cannot be inadvertently filled with oil. Such expansion space shall be at least 10 percent of the total tank volume, except that it shall in no case be less than one-half gallon.

§ 4a.623 *Tank strength.* Oil tanks shall be capable of withstanding an internal test pressure of 5 pounds per square inch without failure or leakage. Tanks shall be so designed and the rivets or welds so located as to resist vibration failures and leakage.

§ 4a.624 *Gauge.* A suitable means shall be provided to determine the amount of oil in the system during the filling operation.

§ 4a.625 *Piping.* Oil piping shall have an inside diameter not less than the inside diameter of the engine inlet or outlet and shall have no splices between connections. Connections in the oil system shall be of a type satisfactory to the Administrator.

§ 4a.626 *Drains.* One or more accessible drains shall be provided at the lowest point on the lubricating systems to drain completely all parts of each system when the airplane is in its normal position on level ground. Such drains shall discharge clear of all parts of the airplane and shall be equipped with suitable safety locks to prevent accidental opening.

§ 4a.627 *Oil temperature.* A suitable means shall be provided for measuring the oil temperature at the engine inlet.

§ 4a.628 *Filler openings.* All filler openings in the oil system shall be plainly marked with the capacity and the word "oil".

COOLING SYSTEMS

§ 4a.633 *General.* The cooling system shall be of sufficient capacity to maintain engine temperatures within safe operating limits under all conditions of flight during a period at least equal to that established by the fuel capacity of the aircraft, assuming normal engine power and speeds. Compliance with this requirement shall be demonstrated in flight tests in which engine temperature measurements are obtained under critical flight conditions including flight with one or more engines inoperative.

§ 4a.634 *Radiators.* Radiators shall be so mounted as to reduce vibration and eliminate strains causing distortion.

§ 4a.635 *Piping.* Piping and connections shall conform to accepted standards and shall not transmit vibration to the radiator or the structure of the aircraft.

§ 4a.636 *Drains.* One or more accessible drains shall be provided at the lowest points on the cooling system to drain completely all parts of such system when the airplane is in its normal position on level ground. Such drains shall discharge clear of all parts of the airplane and shall be equipped with suitable safety locks to prevent accidental opening.

§ 4a.637 *Filler openings.* All filler openings in the cooling system shall be plainly marked with the capacity of the system and the name of the proper cooling liquid.

POWER-PLANT INSTRUMENTS, CONTROLS, AND ACCESSORIES

§ 4a.642 *Instruments.* The engine instruments required are specified in Subpart F. The installation requirements for navigational instruments in § 4a.563 shall apply to tachometers and manifold pressure gauges. All other instruments shall be visible in flight to the pilot and copilot or to the flight mechanic. If the manifold pressure gauges and tachometers are not visible to the flight mechanic, he shall be provided with a duplicate set of these instruments.

§ 4a.643 *Controls.* All power-plant controls, including those of the fuel system, shall be plainly marked to show their function and method of operation.

§ 4a.644 *Throttle controls.* Throttle controls shall be easily accessible to both pilots and shall be so arranged as to afford a positive and immediately responsive means of controlling all engines separately or simultaneously. Flexible throttle control systems shall be of a certificated type. A forward movement shall open the throttle.

§ 4a.645 *Ignition switches.* Ignition switches shall be easily accessible to both pilots. A positive means for quickly shutting off all ignition of multiengine aircraft, by grouping of switches or otherwise, shall be provided.

§ 4a.646 *Propeller pitch controls.* Separate pitch controls shall be provided for each propeller.

§ 4a.647 *Accessories (air carrier planes).* (See § 4a.581.)

MANIFOLDING, COWLING, AND FIRE WALL

§ 4a.651 *General.* All manifolds, cowling, and fire walls shall be so designed and installed as to reduce to a minimum the possibility of fire either during flight or following an accident and shall therefore comply with accepted practice in all details of installation not specified in this part.

§ 4a.652 *Manifolds.* Exhaust manifolds shall be constructed of suitable materials, shall provide for expansion, and shall be arranged and cooled so that local hot points do not form. Gases shall be discharged clear of the cowling, airplane structure, and fuel system parts of drains. They shall not blow back on the carburetor air intake or the pilot or passengers, nor cause a glare ahead of the pilot at night. No exhaust manifolding shall be located immediately adjacent to or under the carburetor or fuel system parts liable to leakage.

§ 4a.653 *Air intakes.* Carburetor air intakes shall be suitably drained and shall open completely outside the cowling, unless the emergence of back-fire flames is positively prevented. The drain shall not discharge fuel in the path of possible exhaust flames.

§ 4a.654 *Engine cowling.* All cowling around the power plant and on the engine side of the fire wall shall be made of metal and shall be so arranged that any accumulations of dirt, waste, or fuel may be observed without complete removal of the cowling. It shall fit tightly to the fire wall, but openings may be provided if the airplane surface within 15 inches thereof is protected with metal or other suitable fireproofing material. The cowling shall be completely and suitably drained in all attitudes of flight and on the ground, with separate drains provided for the parts of the fuel system liable to leakage. All such drains shall be so located as to prevent fuel or oil from dripping onto the exhaust manifold or any parts of the aircraft and from permeating any material of a cellular nature.

§ 4a.655 *Fire wall.* (a) A fire wall shall be provided unless the engine is mounted in an isolated nacelle with no fuel tanks. Such fire bulkhead shall be constructed in either of the following approved manners:

(1) A single sheet of terneplate not less than 0.028 inch thick.

(2) A single sheet of stainless steel not less than 0.015 inch thick.

(3) Two sheets of aluminum or aluminum alloy not less than 0.02" thick fastened together and having between them an asbestos paper or asbestos fabric sheet at least ⅛ inch thick.

(b) The fire wall shall completely isolate the engine compartment and shall have all necessary openings fitted with close-fitting grommets or bushings. Adjacent inflammable structural members shall be protected by asbestos or an equivalent insulating material, and provision shall be made for preventing fuel and oil from permeating it.

§ 4a.656 *Heating systems.* Heating systems involving the passage of cabin air over or in close proximity to engine exhaust manifolds shall not be used, unless adequate precautions are incorporated in the design to prevent the introduction of carbon monoxide into the cabin or pilot compartment. They shall be constructed of suitable materials, be adequately cooled, and be susceptible to ready disassembly for inspection.

MISCELLANEOUS POWER-PLANT REQUIREMENTS

§ 4a.661 *Materials.* Fuel, oil, and cooling systems shall be made of materials which, including their normal or inherent impurities, will not react chemically with any fuels, oils, or liquids that are likely to be placed in them.

SUBPART H—PERFORMANCE

SOURCE: §§ 4a.671 to 4a.760-T contained in Civil Air Regulations, May 31, 1938, as amended by Amdt. 75, 5 F. R. 3946, except as noted following sections affected.

§ 4a.671 *Performance requirements.* All airplanes shall comply with the performance requirements set forth in §§ 4a.680 and 4a.682. All airplanes except those certificated in the transport category shall comply with §§ 4a.672 through 4a.679, inclusive. Compliance with such performance requirements shall be shown in standard atmosphere, at all weights up to and including the standard weight (§ 4a.37 (d)) and under all loading conditions within the center of gravity range certified (§ 4a.725): *Provided,* That demonstration of compliance with landing-speed requirements, and with those relating to take-off time and distance, may be limited to an intermediate range of center of gravity positions if it can be shown that it is possible for the airplane to continue flight with one engine inoperative, and that passengers or other load can be easily and rapidly shifted while in flight to permit the realization, at the pilot's discretion, of a center of gravity position within the range covered by this demonstration. There shall be no flight or handling characteristics which, in the opinion of the Administrator, render the airplane unairworthy.

[Amdt. 04-12, 7 F. R. 1730 as amended by Amdt. 04-2, 8 F. R. 13999]

§ 4a.672 *Landing speeds.* The landing speed with power off, in standard calm air at sea level, shall not exceed a value determined as follows:

(a) Airplanes certificated for passenger carrying:

(1) 65 miles per hour for airplanes of 20,000 pounds standard weight or less,

(2) 70 miles per hour for airplanes of 30,000 pounds standard weight or more, and a linear variation with standard weight shall apply for airplanes between 20,000 and 30,000 pounds.

(b) Airplanes which are certificated for the carriage of goods only:

The above landing speed values may be increased 5 miles per hour.

§ 4a.673 *Take-off.* Take-off at sea level:

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

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

[Amdt. 56, 5 F. R. 2100]

§ 4a.674 *Climb.* The average rate of climb for the first minute after the airplane leaves the take-off surface in accordance with § 4a.673, and the rate of steady climb at sea level with not more than maximum-except-take-off power, shall not be less in feet per minute than:

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

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

[Amdt. 56, 5 F. R. 2100]

§ 4a.675 *Controllability and maneuverability.* All airplanes shall be controllable and maneuverable under all power conditions and at all flying speeds between minimum flying speed and the maximum certified speed. All airplanes shall have control adequate for an average landing at minimum landing speed with power off.

§ 4a.676 *Controllability at the stall.* With power off and with 75 percent maximum-except-take-off power, with flaps and landing gear in any position, the airplane shall have sufficient directional and lateral control so that when the airplane is stalled, the downward pitching motion following the stall shall occur prior to any uncontrollable roll or yaw. Any such pitching motion shall not be excessive and recovery to normal flight shall be possible by normal use of the controls after the pitching motion is unmistakably developed, without excessive loss of altitude.

[Amdt. 04-14, 7 F. R. 5037]

§ 4a.677 *Balance.* As used in the regulations in this part the term "balanced" refers to steady flight in calm air without exertion of control force by the pilot or automatic pilot. Lateral and directional balance is required at cruising speed which for this purpose shall be taken as 90 percent of the high speed in level flight. Longitudinal balance is required under the following flight conditions:

(a) *Power on.* In level flight, at all speeds between cruising speed and a speed 20 percent in excess of stalling speed. In a climb, at maximum (except take-off) horsepower and a speed 20 percent in excess of stalling speed.

(b) *Power off.* In a glide, at a speed not in excess of 140 percent of the maximum permissible landing speed or the placard speed with flaps extended, whichever is lower, under the forward center of gravity position approved with maximum authorized load and under the most forward center of gravity position approved, regardless of weight.

§ 4a.678 *Stability.* Under all power conditions all airplanes shall be longitudinally, laterally, and directionally stable. An airplane will be considered to be longitudinally stable if, in stability tests, the amplitude of the oscillations decreases.

§ 4a.679 *Spinning.* (Not applicable to airplanes certificated in the transport category). At any permissible combination of weight and center of gravity position obtainable with all or part of the design useful load, there shall be no excessive reversal of control forces during any possible spinning up to 6 turns. It shall be possible promptly to recover at any point in the spinning described above by using the controls in a normal manner for that purpose and without exceeding either the limiting air speed or the limit design normal acceleration for the airplane. It shall not be possible to obtain uncontrollable spins by means of any possible use of the controls: *Provided,* That compliance with the foregoing requirements with respect to spinning shall not be required for those airplanes:

(a) Permanently placarded "intentional spinning prohibited"; or

(b) Demonstrated to the satisfaction of the Administrator to be characteristically incapable of spinning.

[Amdt. 04-14, 7 F. R. 5037]

§ 4a.680 *Flutter and vibration.* Wings, tail surfaces, control surfaces, and primary structural parts shall be free from flutter or objectionable vibration in all normal attitudes or conditions of flight between the minimum flying speed and the maximum indicated air speed attained in official flight tests (see § 4a.708).

§ 4a.681-T *Flutter and vibration.* All parts of transport category airplanes shall be free from flutter or excessive vibration under all speed and power conditions appropriate to the operation of the airplane during take-off, climb, level flight, and landing, and during glide at speeds up to the maximum indicated air speed attained during official flight tests (see § 4a.708). There shall be no appreciable buffeting for any flap position at any speed in excess of 10 miles per hour above stalling speed for such position nor shall buffeting at lower speeds be so violent as to interfere with the pilot's control of the airplane or cause discomfort to its occupants.

[Amdt. 40-7, 7 F. R. 984]

§ 4a.682 *Ground and water characteristics.* Landplanes shall be maneuverable on the ground and shall be free from dangerous ground looping tendencies and objectionable taxying characteristics. The seaworthiness and handling characteristics of seaplanes and amphibians shall be demonstrated by tests deemed appropriate by the Administrator.

CROSS REFERENCE: For water stability requirements, see § 4a.491.

MODIFIED PERFORMANCE REQUIREMENTS

§ 4a.687 *Modified performance requirements for multiengine airplanes not certificated in the transport category.* The weight of any multiengine airplane manufactured pursuant to a type certificate issued prior to January 1, 1941, may be increased beyond the values corresponding to the landing speed specified in § 4a.672 and take-off requirements of § 4a.673, subject to the following conditions:

(a) The increased weight shall be known as the provisional weight (§ 4a.37 (e)). The standard weight (§ 4a.37 (d)) shall be the maximum permissible weight for landing. The provisional weight shall be the maximum permissible weight for take-off.

(b) Compliance with all the airworthiness requirements except landing speed and take-off is required at the provisional weight, except that the provisional weight may exceed the design weight on which the structural loads for the landing conditions are based by an amount not greater than 15 percent: *Provided,* That the airplane is shown to be capable of safely withstanding the ground or water shock loads incident to taking off at the provisional weight.

(c) The airplane shall be provided with suitable means for the rapid and safe discharge of a quantity of fuel sufficient to reduce its weight from the provisional weight to the standard weight.

(d) In no case shall the provisional weight exceed a value corresponding to a landing speed of 5 miles per hour in excess of that specified in § 4a.672, a take-off distance of 1,500 feet in the case of landplanes, or a take-off time of 60 seconds in the case of seaplanes; nor shall any provisional weight authorized in respect to any type of airplane after January 1, 1945, exceed the value corresponding to a rate of climb of at least 180 feet per minute at an altitude of 5,000 feet with the critical engine inoperative, its propeller windmilling with the propeller control in a position which would allow the engine (if operating normally and within approved limits) to develop at least 50 percent of maximum-except-take-off engine speed, all other engines operating at the take-off power available at such altitude, the landing gear retracted, center of gravity in the most unfavorable position permitted for take-off, and the flaps in the take-off position.

[Amdt. 04-3, 10 F. R. 3793]

PERFORMANCE TESTS

§ 4a.701 *General.* Compliance with the performance requirements in §§ 4a.-671 through 4a.692 shall be demonstrated by means of suitable flight tests of the type airplane. Computations may be used to estimate the effects of minor changes. Additional information concerning the performance characteristics of air carrier airplanes is specified in § 4a.717. Such characteristics shall be determined by direct flight testing, or by methods combining basic flight tests and calculations. All performance characteristics shall be corrected to standard atmospheric conditions and zero wind. Methods of performance calculation and correction employed shall be subject to the approval of the Administrator.

§ 4a.702 *Flight test pilot.* (a) The applicant shall provide a person holding an appropriate commercial pilot certificate to make the flight tests, but a designated inspector of the Administrator may pilot the airplane during such parts of the tests as he may deem advisable.

(b) In the event that the applicant's test pilot is unable or unwilling to conduct any of the required flight tests, the tests shall be discontinued until the applicant furnishes a competent pilot.

§ 4a.703 *Parachutes.* Parachutes shall be worn by members of the crew during the flight tests.

§ 4a.704 *Reports.* The applicant shall submit to the inspector of the Administrator a report covering all computations and tests required in connection with calibration of flight instruments and correction of tests results to standard atmospheric conditions. The inspector will conduct any flight tests which appear to him to be necessary in order to check the calibration and correction report or to determine the airworthiness of the airplane.

§ 4a.705 *Loading conditions.* The loading conditions used in performance tests shall be such as to cover the range of loads and center of gravity positions for which the airplane is to be certificated.

§ 4a.706 *Use of ballast.* Ballast may be used to enable airplanes to comply with the flight requirements as to longitudinal stability, balance, and landing in accordance with the following provisions:

(a) Ballast shall not be used for this purpose in airplanes having a gross weight of less than 5,000 pounds nor in airplanes with a total seating capacity of less than seven persons.

(b) The place or places for carrying ballast shall be properly designed and installed and plainly marked.

(c) The loading schedule which will accompany each certificate issued for an airplane requiring special loading of this type shall be conspicuously posted in either the pilot compartment or in or adjacent to the ballast compartments, and strict compliance therewith will be required of the airplane operator.

[CAR, May 31, 1938, as amended by Amdt. 48, 5 F. R. 1836]

§ 4a.707 *Fuel to be carried.* When low fuel adversely affects balance or stability, the airplane shall be so tested as to simulate the condition existing when the amount of fuel on board does not exceed 1 gallon for every 12 maximum (except take-off) horsepower of the engine or engines installed thereon. When the engine is limited to a lower power, the latter shall be used in computing low fuel.

§ 4a.708 *Maximum air speed.* The flight tests shall include steady flight in relatively smooth air at the design gliding speed (V_g) for which compliance with the structural loading requirements (§§ 4a.72 through 4a.99) has been proved, except that they need not involve speeds in excess of 1.33 V_L (§ 4a.40 (c)): *Provided,* That the operation limits are correspondingly fixed (see § 4a.726). When high-lift devices having nonautomatic operation are employed, the tests shall also include steady flight at the design flap speed V_f (§ 4a.40 (f)), except that they need not involve speeds in excess of 2 V_{sf} (see § 4a.40 (e)). In cases where the high-lift devices are automatically operated, the tests shall cover the range of speeds within which the devices are operative.

§ 4a.709 *One-engine-inoperative performance.* Multiengine airplanes shall be flight tested at such altitudes and weights as are necessary, in the opinion of the Administrator, to prepare accurate data to show climbing performance within the range of weight for which certification is sought, with the critical engine inoperative and each other engine operating at not more than maximum-except-take-off power. Such data when approved by the Administrator shall be kept in the airplane at all times during flight in a place conveniently accessible to the pilot.

[Amdt. 56, 5 F. R. 2101 as amended by Amdt. 75, 5 F. R. 3947]

§ 4a.710 *Air-speed indicator calibration.* In accordance with § 4a.559, the air-speed indicator of the type airplane shall be calibrated in flight. The method of calibration used shall be subject to the approval of the Administrator.

§ 4a.711 *Check of fuel system.* The operation of the fuel system shall be checked in flight to determine its effectiveness under low fuel conditions and after changing from one supply tank to another. (See § 4a.605.) For such tests low fuel is defined as approximately 15 minutes supply in each tank tested, at the maximum-except-take-off power certified.

AIR CARRIER AIRCRAFT PERFORMANCE CHARACTERISTICS

§ 4a.717 *Performance characteristics of air carrier aircraft.* No air carrier shall operate aircraft in scheduled air transportation unless data shall have been submitted to and approved by the Administrator, covering the determination of such performance characteristics, in addition to those specified in §§ 4a.671–4a.711, as are, in the opinion of the Administrator, necessary to determine the ability of such aircraft to safely perform the type of operation which the air carrier proposes to conduct. The method used for the determination of such ability shall be subject to the approval of the Administrator.

[Amdt. 26, 4 F. R. 3837 as amended by Amdt. 75, 5 F. R. 3947]

OPERATION LIMITATIONS

§ 4a.723 *Weight.* Non-air carrier airplanes may be certificated at a maximum authorized weight which is not sufficient to permit carrying simultaneously the full fuel and full pay load, provided that such weight shall be sufficient to provide a gasoline load of at least 0.15 gallon per certified maximum (except take-off) horsepower, with all seats occupied and with sufficient oil for this amount of fuel.

§ 4a.724 *Provisional weight (air carrier airplanes).* (See §§ 4a.687–4a.692.)

§ 4a.725 *Center of gravity limitations.* The maximum variation in the location of the center of gravity for which the airplane is certificated to be airworthy shall be established. Means shall be provided, when necessary in the opinion of the Administrator, by which the operator is suitably informed of the permissible loading conditions which result in a center of gravity within the certified range.

§ 4a.726 *Air-speed limitations.* Maximum operation limitations will be incorporated in the aircraft certificate and will specify the indicated air speeds which shall not be exceeded in level and climbing flight (§ 4a.40 (c)), in gliding and diving flight, and with flaps extended. The values in gliding flight and with flaps extended will be 10 percent less than the corresponding maximum air speeds attained in flight tests in accordance with § 4a.708.

[Amdt. 5, 4 F. R. 1170]

§ 4a.727 *Power - plant limitations.* Maximum operational limitations will be incorporated in the aircraft certificate and will specify power-plant outputs on take-off (§ 4a.187), in climbing flight, and for all operations other than take-off and climbing flight (§ 4a.38 (b)). The output, except for take-off, shall not exceed that corresponding to the maximum (except take-off) rating of the engine installed. For the above purposes no specified output will be in excess of that corresponding to the limits imposed by either the pertinent engine or propeller certification (see §§ 4a.25 and 4a.26).

[Amdt. 5, 4 F. R. 1170]

TRANSPORT CATEGORY AIRPLANE PERFORMANCE REQUIREMENTS

§ 4a.737–T *Performance requirements for transport category airplanes.* The following requirements shall apply in place of §§ 4a.672–4a.679.

[Amdt. 04–8, 7 F. R. 985, as amended by Amdt. 04–2, 8 F. R. 13999]

§ 4a.738–T *Minimum requirements for certification.* (a) An airplane may be certificated under the provisions of § 4a.737–T upon there having been established, in accordance with the terms of that section:

(1) A maximum take-off weight at sea level;

(2) A maximum landing weight at sea level;

(3) A maximum one-engine-inoperative operating altitude (as defined in § 4a-741–T), which shall be at least 5,000 feet at a weight equal to the maximum sea level take-off weight;

(4) Take-off characteristics at maximum sea level take-off weight, and landing characteristics at maximum sea level landing weight, in accordance with the provisions of §§ 4a.747–T and 4a.750–T, and

(5) Compliance with the requirements of all other applicable parts of the regulations of this part.

(b) If a certificate is issued under these conditions, it may be amended from time to time to include landing and take-off weights over an increased range of altitudes and other pertinent performance data, including additional landing and take-off characteristics obtained in accordance with the provisions of §§ 4a.747–T and 4a.750–T.

[Amdt. 04–8, 7 F. R. 985]

DEFINITIONS

§ 4a.739–T *Stalling speeds.* In §§ 4a.737–T through 4a.760–T:

(a) V_{s_0} denotes the true indicated stalling speed of the airplane in miles per hour with engines idling, throttles closed, propellers in low pitch, landing gear extended, flaps in the "landing position", as defined in § 4a.740–T, cowl flaps closed, center of gravity in the most unfavorable position within the allowable landing range, and the weight of the airplane equal to the weight in connection with which V_{s_0} is being used as a factor to determine a required performance.

(b) V_{s_1} denotes the true indicated stalling speed in miles per hour with engines idling, throttles closed, propellers in low pitch, and with the airplane in all other respects (flaps, landing gear, etc.) in the condition existing in the particular test in connection with which V_{s_1} is being used.

[Amdt. 04–8, 7 F. R. 985]

§ 4a.740–T *Flap positions.* The flap positions denoted respectively as the landing position, approach position, and take-off position are those provided for in § 4a.464–T, and may be made variable with weight and altitude in accordance with that section.

[Amdt. 04–8, 7 F. R. 985]

§ 4a.741–T *Maximum one-engine-inoperative operating altitude.* Maximum one-engine-inoperative operating altitude (to be determined in complying with § 4a.709) shall be the altitude in standard air at which the steady rate of climb in feet per minute is 0.02 $V_{s_0}^2$ with the critical engine inoperative, its propeller stopped, all other engines operating at the maximum-except-take-off power available at such altitude, the landing gear retracted, and the flaps in the most favorable position.

[Amdt. 04–8, 7 F. R. 985]

WEIGHTS

§ 4a.742–T *Weights.* The maximum take-off weight and maximum landing weight shall be established by the applicant and may be made variable with altitude. The maximum take-off weight for any altitude shall not exceed the maximum design weight used in the structural loading conditions for flight loads (§§ 4a.72–4a.99), and shall not exceed the design weight used in the structural loading conditions for ground or water loads (§§ 4a.147–4a.156 and §§ 4a.161–4a.177, respectively) by a ratio of more than 1.15. The maximum landing weight for any altitude shall not exceed the design weight used in the structural loading conditions for ground or water loads.

[Amdt. 04–8, 7 F. R. 985]

§ 4a.743–T *Fuel dumping provisions.* (a) If the maximum take-off weight for any altitude exceeds the maximum landing weight for the same altitude, adequate provision shall be made, in accordance with Subpart G, for the rapid and safe dumping during flight of a quantity of fuel sufficient to reduce the weight of the airplane from such maximum take-off weight to such maximum landing weight. Compliance with this section shall be shown by dumping suitable colored fluids and fuel in flight tests in the following conditions:

(1) Level flight at a speed of 2.0 V_{s_1}.

(2) Climb at a speed of 1.4 V_{s_1} with 75 percent of maximum-except-take-off power,

(3) Glide with power off at a speed of 1.4 V_{s_1}.

(b) In conditions (a) (1) and (2), the time required to dump the necessary amount of fuel shall not exceed 10 minutes. During such tests, the dumped fluid shall not come in contact with any portion of the aircraft or adversely affect its control, nor shall any fumes from such fluid enter any portion of the aircraft.

[Amdt. 04–8, 7 F. R. 985]

PERFORMANCE REQUIREMENTS AND DETERMINATIONS

§ 4a.744–T *Required performance and performance determinations.* Performance data shall be corrected to standard atmosphere and still air where such corrections are applicable. Performance data may be determined by calculation from basic flight tests if the results of such calculation are substantially equal in accuracy to the results of direct tests.

[Amdt. 04–8, 7 F. R. 985]

§ 4a.745–T *Stalling speed requirements.* (a) V_{s_0} at maximum landing weight shall not exceed 80 miles per hour.

(b) V_{s_1} at maximum landing weight, flaps in the approach position, landing gear extended, and center of gravity in the most unfavorable position permitted for landing, shall not exceed 85 miles per hour.

[Amdt. 04–8, 7 F. R. 985]

§ 4a.746–T *Climb requirements.* In the climb tests required by this section, the engine cowl flaps, or other means of controlling the engine cooling air supply, shall be in a position which will provide adequate cooling with maximum-except-take-off power at best climbing speed under standard atmospheric conditions.

(a) *Flaps in landing position.* The steady rate of climb in feet per minute, at any altitude within the range for which landing weight is to be specified in the certificate, with the weight equal to maximum landing weight for that altitude, all engines operating at the take-off power available at such altitude, landing gear extended, center of gravity in the most unfavorable position permitted for landing, and flaps in the landing position, shall be at least 0.07 $V_{s_0}^2$.

(b) *Flaps in approach position.* The steady rate of climb in feet per minute, at any altitude within the range for which landing weight is to be specified in the certificate, with the weight equal to maximum landing weight for that altitude, the critical engine inoperative, its propeller stopped, all other engines operating at the take-off power available at such altitude, the landing gear retracted, center of gravity in the most unfavorable position permitted for landing, and the flaps in the approach position, shall be at least 0.04 $V_{s_0}^2$.

(c) *Flaps in take-off position.* The steady rate of climb in feet per minute, at any altitude within the range for which take-off weight is to be specified in the certificate, with the weight equal to maximum take-off weight for that altitude, the speed equal to the minimum take-off climb speed permitted in § 4a.748–T (b), the critical engine inoperative, its propeller windmilling with the propeller control in a position which would allow the engine (if operating normally and within approved limits) to develop at least 50 percent of maximum-except-take-off engine speed, all other engines operating at the take-off power available at such altitude, the landing gear retracted, center of gravity in the most unfavorable position permitted for take-off, and the flaps in the take-off position, shall be at least 0.035 $V_{s_1}^2$.

[Amdt. 04–8, 7 F. R. 985]

§ 4a.747–T *Take-off determination.* The take-off data set forth in §§ 4a.748–T and 4a.749–T shall be determined over such range of weights and altitudes as the applicant may desire, with a constant take-off flap position for a particular weight and altitude, and with the operating engines at not more than the take-off power available at the particular altitude. These data shall be based on a level take-off surface with zero wind.

[Amdt. 04–8, 7 F. R. 986]

§ 4a.748–T *Speeds*—(a) *Critical-engine-failure speed,* denoted by V_1, is a true indicated air speed, chosen by the applicant, but in any case not less than the minimum speed at which the controllability is adequate to proceed safely with the take-off, using normal piloting skill, when the critical engine is suddenly made inoperative.

(b) *Minimum take-off climb speed,* denoted by V_2, is a true indicated air speed chosen by the applicant, which shall permit the rate of climb required in § 4a.746–T (c) but which shall not be less than 1.20 V_{s_1} for two-engined airplanes, or 1.15 V_{s_1} for airplanes having more than two engines, or less than 1.10 times the minimum speed at which the airplane is fully controllable in flight using normal piloting skill when the critical engine is suddenly made inoperative.

[Amdt. 04–8, 7 F. R. 986]

§ 4a.749–T *Take-off path.* The lengths and slopes of segments of the take-off path, and the location of critical points on the complete path shall be determined in accordance with the following conditions and assumptions. The location of the points defined in paragraphs (a) to (e) of this section shall be expressed in terms of the horizontal and vertical distances from the starting point.

(a) *Starting point.* The point from which a standing start is made with all engines operating.

(b) *Critical-engine-failure point.* The point at which the airplane attains speed V_1 (critical-engine-failure speed) when accelerated from point (a) with all engines operating.

(c) *Accelerate-and-stop point.* The point on the take-off surface at which the airplane can be brought safely to a stop if all engines are cut at point (b).

(d) *Start-of-climb point.* The point on or just clear of the take-off surface at which the airplane attains speed V_2 (take-off climb speed) when the critical engine is made inoperative with its propeller windmilling in low pitch at point (b).

The take-off acceleration segment, (a) to (d), shall be determined by making a continuous run up to speed V_2 with the critical engine cut at point (b).

(e) *Retraction-completion point.* The point at which landing gear retraction is completed when retraction is initiated not earlier than point (d).

(1) The initial climb segment, (d) to (e), shall be assumed to correspond to the rate of climb at speed V_2 with landing gear extended and windmilling propeller in low pitch.

(2) The second climb segment, beginning at point (e), shall be assumed to correspond to the rate of climb at speed V_2 with landing gear retracted and windmilling propeller in high pitch, as defined in § 4a.746–T (c). This segment may continue indefinitely or may end at point (g) in accordance with paragraph (g) of this section.

(f) *50-foot height point.* The point at which the airplane attains a height of 50 feet (above the take-off surface) along the take-off flight path defined herein.

(g) *Feathering-completion point.* The point where feathering or stopping of the inoperative propeller is completed, if the applicant desires to include this step in the take-off determination. It shall be assumed that the decision to feather or stop is made not earlier than the instant of attaining point (f).

(1) In the event that it is desired to include propeller feathering or stopping in the take-off path, the final climb segment, beginning at point (g), shall be assumed to correspond to the rate of climb at speed V_2 with landing gear retracted and the propeller of the inoperative engine feathered or stopped.

§ 4a.750–T. *Landing determination.* The horizontal distance required to land and come to a complete stop from a point at a height of 50 feet above the landing surface shall be determined for such range of weights and altitudes as the applicant may desire. In making this determination:

(a) Immediately prior to reaching the 50-foot altitude, a steady gliding approach shall have been maintained, with a true indicated air speed of at least 1.3 V_{s_0}.

(b) The nose of the airplane shall not be depressed, nor the power increased, after reaching the 50-foot altitude. At all times during and immediately prior to the landing, the flaps shall be in the landing position, except that after the airplane is on the landing surface and the true indicated air speed has been reduced to not more than 0.9 V_{s_0} the flap position may be changed.

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

(d) The brakes shall not be used in such manner as to produce excessive wear of brakes or tires.

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

[Amdt. 04–8, 7 F. R. 986]

FLIGHT CHARACTERISTICS

§ 4a.751–T *Flight characteristics.* There shall be no flight characteristic which makes the airplane unairworthy. The airplane shall also meet the following requirements under all critical loading conditions within the range of center of gravity, and, except as provided in § 4a.753 (d), at the maximum weight for which certification is sought.

[Amdt. 04–8, 7 F. R. 986, as amended by Amdt. 04–2, 8 F. R. 13999]

§ 4a.752–T *Controllability and maneuverability.* The airplane shall be controllable and maneuverable during take-off, climb, level flight, glide, and landing, and it shall be possible to make a smooth transition from one flight condition to another, without requiring an exceptional degree of skill, alertness, or strength on the part of the pilot, under all conditions of operation probable for the type, including those conditions normally encountered in the event of sudden failure of any engine. It shall be possible, with power off, with flaps either retracted or in the landing position, with the center of gravity in the most unfavorable location within the certificated range, and with the airplane trimmed for a speed of 1.4 V_{s_1}, to change the flap position to the opposite extreme, to make a sudden application of take-off power on all engines, or to change the speed to any value between 1.10 V_{s_1}, and 1.70 V_{s_1}, without requiring a change in the trim control or the exertion of more control force than can readily be applied with one hand for a short period. It shall not be necessary to use exceptional piloting skill in order to prevent loss of altitude when flap retraction from any position is initiated during steady horizontal flight at 1.1 V_{s_1}, with simultaneous application of not more than maximum-except-take-off power.

[Amdt. 04–8, 7 F. R. 986]

§ 4a.753–T *Trim.* The means used for trimming the airplane shall be such that after being trimmed and without further pressure upon or movement of either the primary control or its corresponding trim control by the pilot or the automatic pilot, the airplane will maintain:

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

(b) Longitudinal trim, under the following conditions:

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

(2) During a glide with power off at a speed not in excess of 1.4 V_{s_1}, and

(3) During level flight at any speed from 90 percent of high speed to the sum of V_{s_1} and 20 percent of the difference between high speed and V_{s_1};

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

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

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

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

[Amdt. 04–8, 7 F. R. 986]

§ 4a.754–T *Stability.* The airplane shall be longitudinally, directionally, and laterally stable in accordance with the following provisions. Suitable stability and control "feel" may be required in other conditions normally encountered in service if flight tests show such stability to be necessary for safe operation.

[Amdt. 04–8, 7 F. R. 987]

§ 4a.755–T *Static longitudinal stability.* In the flight conditions described in § 4a.756–T,

(a) At any speed which can be obtained without excessive control force and which is more than 10 miles per hour above or below the specified trim speed, but not greater than the appropriate maximum permissible speed or less than the minimum speed in steady unstalled flight, the characteristics of the elevator control forces and friction shall be such that:

(1) A pull is required to maintain speeds below the specified trim speed and a push to maintain speeds above the specified trim speed.

(2) The control will, when unrestrained by the pilot, move continuously toward its original trim position.

(b) Where a stable slope of the stick force versus speed curve is specified, any decrease in speed below trim speed shall require an increase in the steady pull on the elevator control and any increase in speed above trim speed shall require an increase in the steady push on the control. Such slope shall be between such limits that any substantial change in speed is clearly perceptible to the pilot through a resulting change in stick force, and that the stick force required to produce necessary changes in speed does not reach excessive values.

[Amdt. 04–8, 7 F. R. 987]

§ 4a.756–T *Specific stability conditions*—(a) *Landing.* With flaps in the sea level landing position, the landing gear extended, maximum sea level landing weight, the airplane trimmed at 1.4 V_{s_1} and throttles closed, the stick force curve shall have a stable slope at all speeds between 1.1 V_{s_1} and 1.8 V_{s_1}.

(b) *Approach.* With flaps in sea level approach position, landing gear retracted, maximum sea level landing weight, the airplane trimmed at 1.4 V_{s_1} and with power sufficient to maintain level flight at this speed, the stick force curve shall have a stable slope at all speeds between 1.1 V_{s_1} and 1.8 V_{s_1}.

(c) *Climb.* With flaps retracted, landing gear retracted, maximum sea level take-off weight, 75 percent of maximum-except-take-off power, and with the airplane trimmed at 1.4 V_{s_1}, the stick force curve shall have a stable slope at all speeds between 1.2 V_{s_1} and 1.6 V_{s_1}.

(d) *Cruising.* With flaps retracted, maximum sea level take-off weight, 75 percent of maximum-except-take-off power, and with the airplane trimmed for level flight, the stick force curve shall have a stable slope at all speeds obtainable with reasonable stick forces between:

(1) 1.2 V_{s_1} and the maximum permissible speed, when the landing gear is retracted;

(2) 1.2 V_{s_1} and the level flight speed, when the landing gear is extended.

[Amdt. 04-8, 7 F. R. 987]

§ 4a.757-T *Dynamic longitudinal stability.* The airplane shall not be dynamically unstable longitudinally, as shown by the damping of the normal long period oscillation, under any flight condition that is likely to be maintained for more than 10 minutes in ordinary service. Compliance with this requirement shall be demonstrated under at least the following conditions:

(a) During level flight with 75 percent of maximum-except-take-off power.

(b) During a climb with 75 percent of maximum-except-take-off power at a speed equal to 75 percent of that obtained in paragraph (a) of this section.

Any short period oscillation occurring between stalling speed and maximum permissible speed shall be heavily damped with the primary controls in a fixed position.

[Amdt. 04-8, 7 F. R. 987]

§ 4a.758-T *Directional and lateral static stability.* The static directional stability, as shown by the tendency to recover from a skid with rudder free, shall be positive for all flap positions and symmetrical power conditions, and for all speeds from 1.2 V_{s_1} up to the maximum permissible speed. The static lateral stability as shown by the tendency to raise the low wing in a sideslip, shall be positive within the same limits.

[Amdt. 04-8, 7 F. R. 987]

§ 4a.759-T *Stalling.* With power off, and with that power necessary to maintain level flight with flaps in approach position at a speed of 1.6 V_{s_1}, maximum landing weight, flaps and landing gear in any position, and center of gravity in the least favorable position for recovery, it shall be possible to produce and to correct roll and yaw by unreversed use of the aileron and rudder controls up to the time when the airplane pitches in the maneuver described below. During the pitching and recovery portions of the maneuver it shall be possible to prevent appreciable rolling or yawing by normal use of the controls.

In demonstrating this quality, the order of events shall be:

(a) With trim controls adjusted for straight flight at a speed of 1.4 V_{s_1}, reduce speed by means of the elevator control until the speed is steady at slightly above stalling speed; then

(b) Pull elevator control back at a normal rate until a stall is produced as evidenced by an uncontrollable downward pitching motion of the airplane, or until the control reaches the stop. Normal use of the elevator control for recovery may be made after such pitching motion is unmistakably developed.

In any case, the airplane shall not pitch excessively before recovery is completed.

The airplane shall be recoverable without difficulty or the use of power from the inoperative engine when it is stalled with the critical engine inoperative and the remaining engines operating at 75 percent of maximum-except-take-off power.

[Amdt. 04-8, 7 F. R. 987]

OPERATING MANUAL

§ 4a.760-T *Airplane operating manual.* There shall be furnished with each airplane a copy of a manual which shall contain such information regarding the operation of the airplane as the Administrator may require, including, but not limited to, the following:

(a) All performance data secured under §§ 4a.741-T through 4a.750-T together with any pertinent descriptions of the conditions, air speeds, etc., under which such data were determined.

(b) Adequate instructions for the use and adjustment of the flap controls under § 4a.464-T.

(c) The indicated air speeds corresponding to those determined in § 4a.748-T, together with pertinent discussion of procedures to be followed if the critical engine becomes inoperative on take-off.

(d) A discussion of any significant or unusual flying or ground-handling characteristics, knowledge of which would be useful to a pilot not previously having flown the airplane.

[Amdt. 04-8, 7 F. R. 987]

§ 4a.760-T-1 *Airplane flight manuals (CAA policies which apply to § 4a.760-T).* See § 4b.911-1 of this subchapter.

[Supp. 2, 13 F. R. 4182. Correction noted at 14 F. R. 37]

SUBPART I—MISCELLANEOUS REQUIREMENTS

SOURCE: §§ 4a.771 and 4a.772 contained in Civil Air Regulations, May 31, 1938.

§ 4a.771 *Standard weights.* In computing weights the following standard values shall be used:

Gasoline	6 pounds per gallon.
Lubricating oil	7.5 pounds per gallon.
Crew and passengers	170 pounds per person, unless otherwise specified by the Administrator.
Parachutes	20 pounds each.

§ 4a.772 *Leveling means.* Adequate means shall be provided for easily determining when the aircraft is in a level position.

APPENDIX—TABLES AND FIGURES

TABLE 4a-1.—SYMMETRICAL FLIGHT CONDITIONS (FLAPS RETRACTED)

1. Condition	I	II	III	IV	V	VI
2. Reference	§ 4a.79	§ 4a.81	§ 4a.82	§ 4a.83	§ 4a.84	§ 4a.85
3. Design Speed (see § 4a.73)	V_L	V_L	V_g	V_g	V_L	V_g
4. Gust Velocity, U, f. p. s. (1) (2)	+30	−30	+15	−15	....	....
5. Δn (a) Gust (3)	§ 4a.76	§ 4a.76	§ 4a.76	§ 4a.76	$-0.5\Delta n_{Ia}$	....
Δn (b) Maneuvering	Fig. 4a-3	....	Fig. 4a-3	....	$-0.25\Delta n_{Ib}$	....
6. Limit Load Factor, n. When item 5 gives two values of Δn, use larger	$1+\Delta n_I$	$1+\Delta n_{II}$	$1+\Delta n_{III}$	$1+\Delta n_{IV}$	$-1+\Delta n_V$	....
7. Minimum Value of n	2.50	None	2.50	None	−1.5	None
8. Minimum Yield Factor of Safety, j_y	1.0	1.0	1.0	1.0	1.0	1.0
9. Minimum Ultimate Factor of Safety, j_u	1.5	1.5	1.5	1.5	1.5	1.5

(1) Feet per second.
(2) + means upward, − means downward.
(3) May be limited by maximum dynamic lift coefficient obtainable under sudden changes of angle of attack.

[CAR, May 31, 1938, as amended by Amdt. 48, 5 F. R. 1837]

TABLE 4a-2.—SYMMETRICAL FLIGHT CONDITIONS (FLAPS EXTENDED)

1. Condition	VII	VIII	IX
2. Reference	§ 4a.87	§ 4a.88	§ 4a.89
3. Design Speed (see § 4a.73)	V_f	V_f	V_f
4. Gust Velocity, U, f. p. s. (1) (2)	+15	−15	....
5. Δn (3)	§ 4a.76	§ 4a.76	....
6. Limit Load Factor, n	$1+\Delta n_{VII}$	$1+\Delta n_{VIII}$	....
7. Minimum Value of n	2.00	None	None
8. Minimum Yield Factor of Safety, j_y	1.0	1.0	1.0
9. Minimum Ultimate Factor of Safety, j_u	1.5	1.5	1.5

(1) Feet per second.
(2) + means upward, − means downward.
(3) May be limited by maximum dynamic lift coefficient obtainable under sudden changes of angle of attack.

[CAR, May 31, 1938, as amended by Amdt. 48, 5 F. R. 1837]

TABLE 4a-3.—LOADING CONDITIONS FOR HORIZONTAL TAIL SURFACES

1. Condition	Balancing	Maneuvering	Damping	Tab effects
2. Reference	§ 4a.116	§ 4a.117	§ 4a.118	§ 4a.119
3. Design Speed (see § 4a.73)	....	V_p	....	V_L
4. Force Coefficient, C_N	....	$\left\{\begin{matrix} -.55 \text{ (down)} \\ +.35 \text{ (up)} \end{matrix}\right\}$	....	....
5. Average Limit Pressure, p. s. f. (1)	....	$C_N q_p$ (2)	....	....
6. Chord Distribution	Fig. 4a-4	Fig. 4a-5	Fig. 4a-6	Fig. 4a-5 (3)
7. Span Distribution	Constant C_N	Constant C_N	Constant C_N	Constant C_N (3)
8. Minimum Average Limit Pressure, p. s. f. (1)	....	15	....	....
9. Special Requirements	None	None	None	None
10. Minimum Yield Factor of Safety, j_y	1.0	1.0	1.0	1.0
11. Minimum Ultimate Factor of Safety, j_u	1.5	1.5	1.5	1.5

(1) Over entire horizontal tail.
(2) q_p is the dynamic pressure corresponding to V_p, see § 4a.42.
(3) Refers to main surface, disregarding tab; uniform pressure distribution may be assumed over tab

[CAR, May 31, 1938, as amended by Amdt. 48, 5 F. R. 1837]

TABLE 4a-4.—LOADING CONDITIONS FOR VERTICAL TAIL SURFACES

1. Condition	Maneuvering	Damping	Gust	Tab effects
2. Reference	§ 4a.120	§ 4a.121	§ 4a.122	§ 4a.123
3. Design Speed (see § 4a.73)	V_p(2)		V_L	V_L(4)
4. C_N or Gust	C_N=0.45		U=30 f. p. s.	
5. Average Limit Pressure, p. s. f.(1)	$C_N q_p$(3)		§ 4a.122(b)	
6. Chord Distribution	Fig. 4a-5	Fig. 4a-6	Fig. 4a-6(5)	Fig. 4a-5(6)
7. Span Distribution	Constant C_N	Constant C_N	Constant C_N	Constant C_N(6)
8. Minimum Average Limit Pressure, p. s. f.(1)	12			
9. Special Requirements	4a.120 (b)	None	None	None
10. Minimum Yield Factor of Safety, j_y	1.0	1.0	1.0	1.0
11. Minimum Ultimate Factor of Safety, j_u	1.5	1.5	1.5	1.5

(1) Over entire vertical tail.
(2) q_p is the dynamic pressure corresponding to V_p (see § 4a.42).
(3) See § 4a.120 (a) for exception.
(4) See § 4a.123 (b) for exception
(5) See § 4a.122 (c).
(6) Refers to main surface, disregarding tab; uniform pressure distribution may be assumed over tab

[CAR, May 31, 1938, as amended by Amdt. 5. 4 F. R. 1170]

TABLE 4a-5.—LOADING CONDITIONS FOR AILERONS

1. Condition	Maneuvering	Tab effects
2. Reference	§ 4a.125	§ 4a.126
3. Design Speed (see § 4a.73)	V_p(1)	V'_L(3)
4. C_N or Gust	C_N=0.45	
5. Average Limit Pressure, p. s. f	$C_N q_p$(2)	
6. Chord Distribution	Fig. 4a-7	Fig. 4a-7(4)
7. Span Distribution	Constant C_N	Constant C_N(4)
8. Minimum Average Limit Pressure, p. s. f	12	
9. Special Requirements	§ 4a.125(b)	None
10. Minimum Yield Factor of Safety, j_y	1.0	1.0
11. Minimum Ultimate Factor of Safety, j_u	1.5	1.5

(1) See § 4a.125 (a) for exception.
(2) q_p is the dynamic pressure corresponding to V_p (see § 4a.42).
(3) V'_L is the maximum level flight air speed with any engine inoperative.
(4) Refers to main surface disregarding tab: uniform pressure distribution may be assumed over tab.

[CAR, May 31, 1939]

TABLE 4a-6.—LOADING CONDITIONS FOR CONTROL SYSTEMS

(See § 4a.137)

	Elevator	Rudder		Aileron	Flaps, tabs. etc
		Symmetrical thrust (1)	Unsymmetrical thrust (2)		
1. Reference	.139	.140	140	141	.142
2. Maximum Limit Control Force, pounds	200	200	200	80	None
3. Minimum Limit Control Force, pounds	Fig. 4a-8	130	200	Fig. 4a-9	See Ref.
4. Minimum Yield Factor of Safety, j_y	1.0	1.0	1.0	1.0	1.0
5. Minimum Ultimate Factor of Safety, j_u	1.5	1.5	1.5	1.5	1.5

(1) Propeller axes all in plane of symmetry.
(2) Propeller axes not all in plane of symmetry.

TABLE 4a-7.—ADDITIONAL (MULTIPLYING) FACTORS OF SAFETY

(See §§ 4a.207-4a.216)

Item	Component	Reference	Additional yield factor of safety, j_y	Additional ultimate factor of safety, j_u	May be covered by Item No.
1.	Fittings (except control system fittings)	§ 4a.208	None	1.20	2, 4, 5, 6, 7, 8, 9
2.	Castings	§ 4a.209	None	2.00	7, 8
3.	Parallel double wires in wing lift truss	§ 4a.210	None	1.05	4
4.	Wires at small angles	§ 4a.211	None	See Ref.	
5.	Double drag truss wires	§ 4a.212	None	See Ref.	
6.	Torque tubes used as hinges	§ 4a.213	None	1.5	
7.	Control surface hinges (1)	§ 4a.214	None	6.67	
8	Control system joints (1)	§ 4a.214	None	3.33	
9.	Wire sizes	§ 4a.215	None	See Ref.	
10.	Wing lift truss (landing conditions only)	§ 4a.216	None	1.10	

(1) For bearing stresses only.

[CAR, May 31, 1939, as amended by Amdt. 5, 4 F. R. 1170]

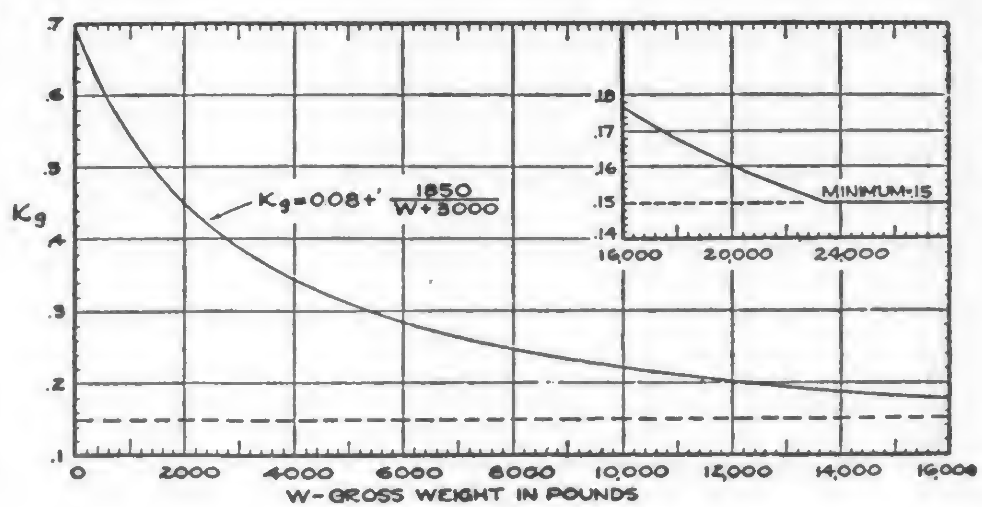


FIGURE 4a-1.—GLIDING SPEED FACTOR.

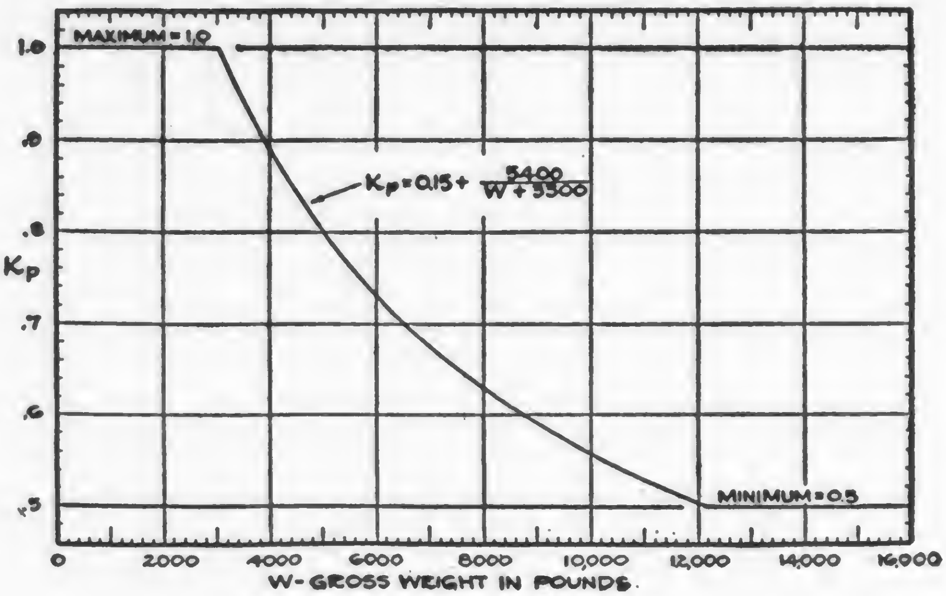


FIGURE 4a–2.—PULL-UP SPEED FACTOR.

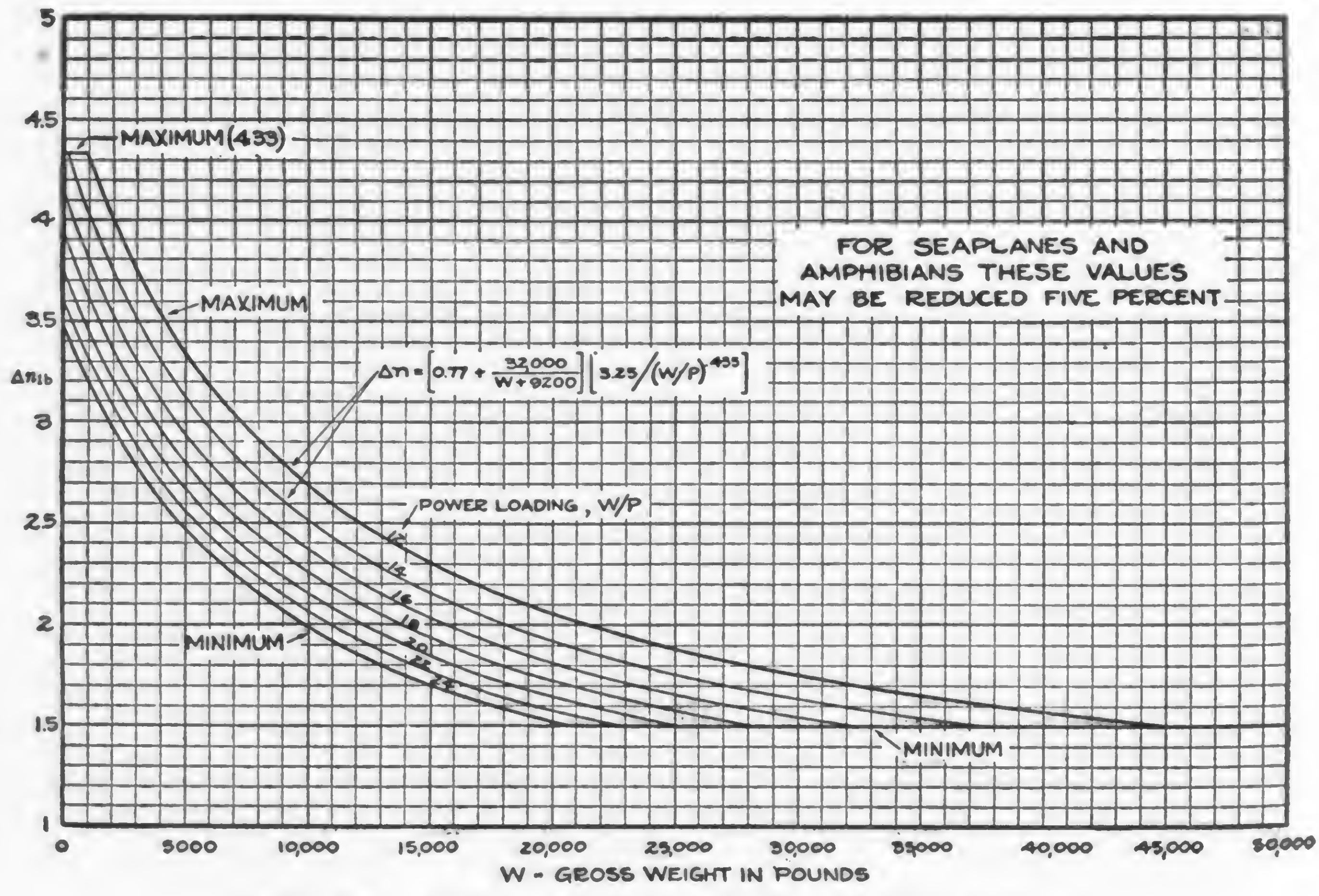


FIGURE 4a–3.—MANEUVERING LOAD FACTOR INCREMENT, CONDITIONS I AND III.

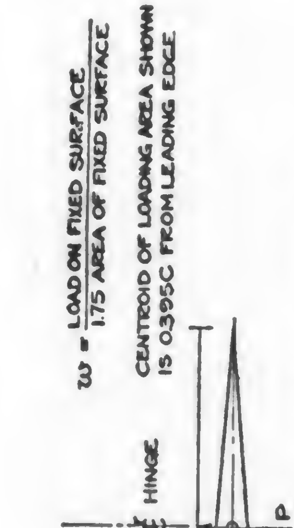


FIGURE 4a4.—"BALANCING" DISTRIBUTION—HORIZONTAL TAIL.

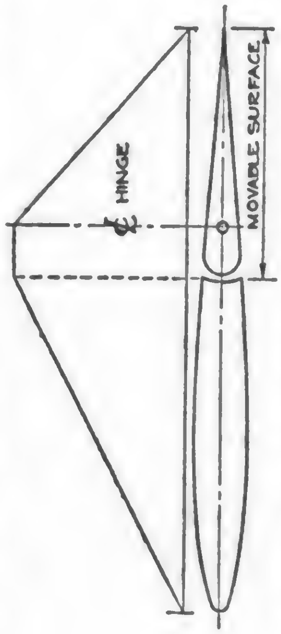


FIGURE 4a5.—"MANEUVERING" TAIL LOAD DISTRIBUTION.

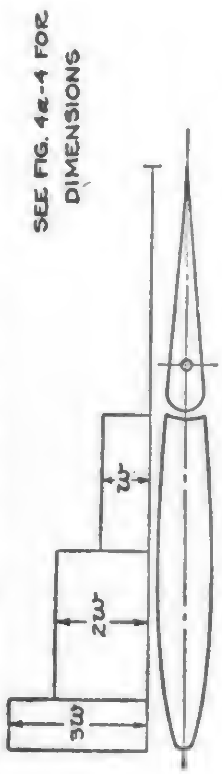


FIGURE 4a-6.—"DAMPING" TAIL LOAD DISTRIBUTION.

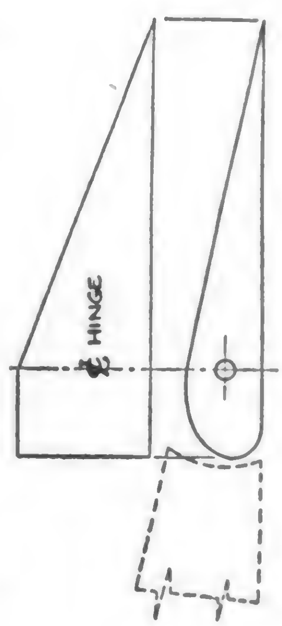


FIGURE 4a-7.—AILERON LOAD DISTRIBUTION.

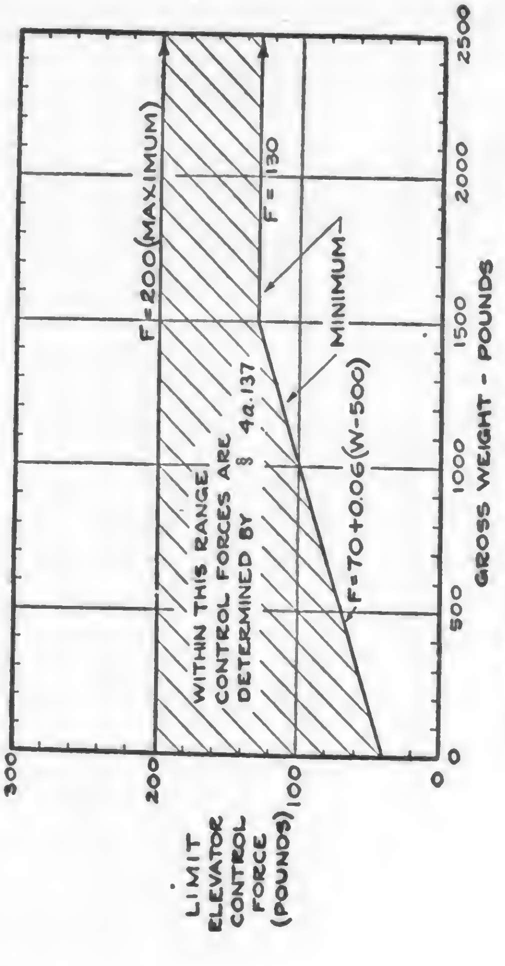


FIGURE 4a-8.—ELEVATOR CONTROL FORCE LIMITS.

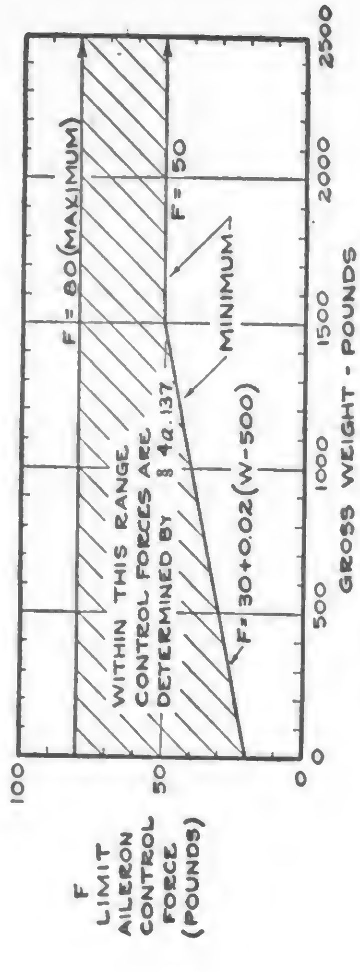


FIGURE 4a-9.—AILERON CONTROL FORCE LIMITS.

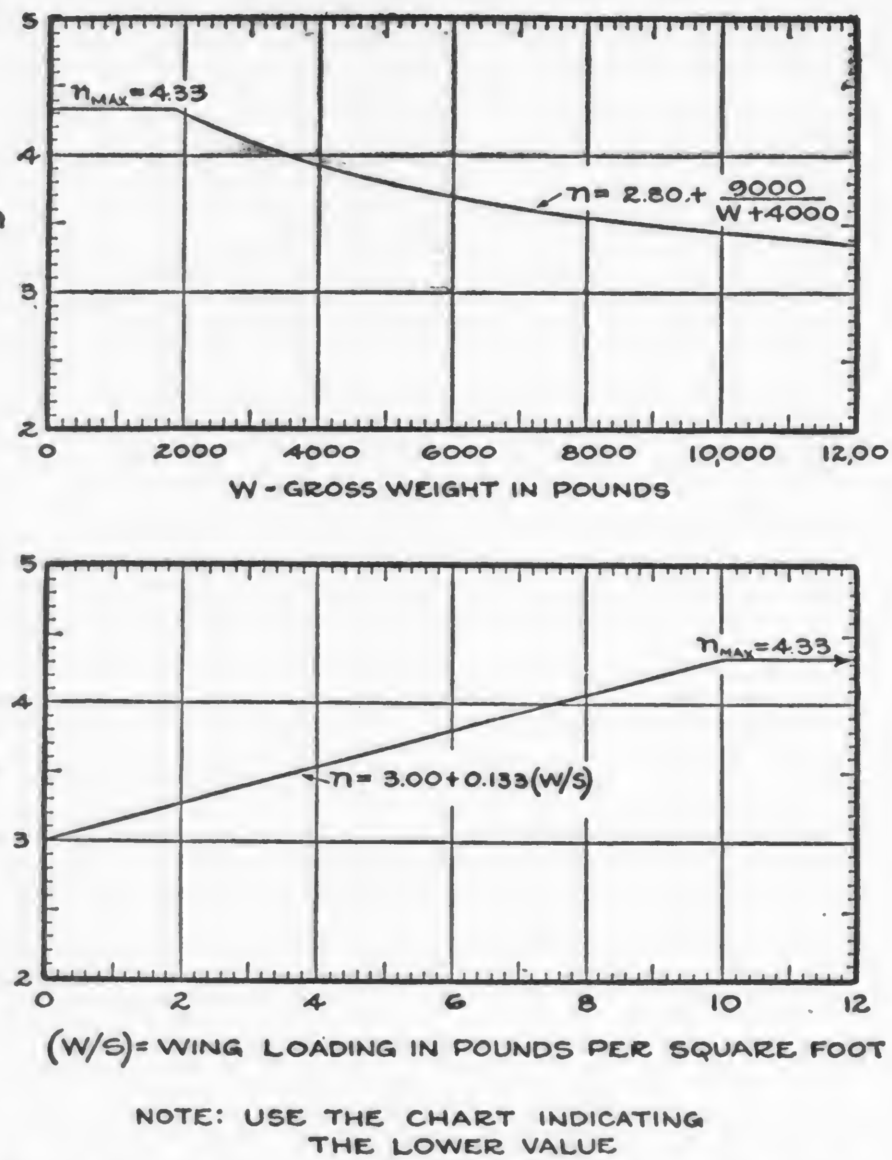


FIGURE 4a-10.—LIMIT LOAD FACTORS FOR LEVEL AND 3-POINT LANDING CONDITIONS.

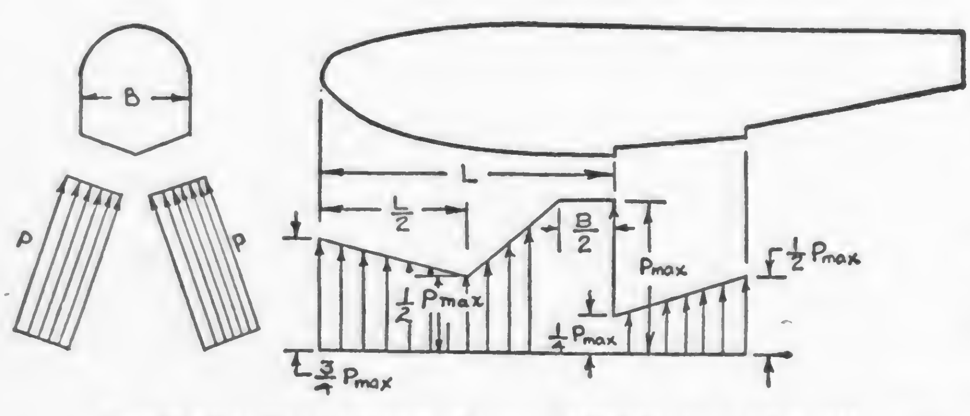


FIGURE 4a-11.—DISTRIBUTION OF LOCAL PRESSURES—BOAT SEAPLANES.

PART 4b—AIRPLANE AIRWORTHINESS; TRANSPORT CATEGORIES

SUBPART A—AIRWORTHINESS REQUIREMENTS

GENERAL

AUTHORITY: §§ 4b.1 to 4b.932 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 601, 603, 52 Stat. 1007, 1009; 49 U. S. C. 551, 553.

SOURCE: §§ 4b.1 to 4b.932 contained in Amendment 04-0, Civil Air Regulations, 11 F. R. 71, except as noted following provisions affected.

SUBPART A—AIRWORTHINESS REQUIREMENTS

GENERAL

§ 4b.1 *Scope.* An airplane shall be shown to comply with the airworthiness requirements set forth in this part and shall have no characteristic which, according to the findings of the Administrator, makes the airplane unairworthy in order to become eligible for type and airworthiness certificates: *Provided,* That:

(a) If any of the requirements of this part become inapplicable to a particular airplane because of increased knowledge of aeronautics or of the development of unforeseen design features, the Administrator shall accept designs shown to provide an equivalent standard of safety.

(b) Other requirements with respect to airworthiness found by the Administrator to provide an equivalent standard of safety shall be accepted in lieu of the requirements set forth in this part.

§ 4b.2 *Date of effectiveness.* (a) Aircraft certificated as a type on or after November 9, 1945, shall comply either with (1) the entire provisions of Part 4a of this chapter in effect immediately prior to that date, or (2) the entire provisions prescribed in this part except that aircraft certificated under subparagraph (1) of this paragraph may incorporate provisions of subparagraph (2) of this paragraph when the Administrator finds the standard of safety to be equivalent to the particular and all related items of the latter.

(b) Aircraft certificated as a type on or after January 1, 1948, shall comply with the provisions of this part. If the prototype is not flown prior to January 1, 1948, and satisfactory evidence is presented indicating that the design work of the type was well advanced prior to November 9, 1945, and the delay of completion of the airplane was due to causes beyond the manufacturer's control, the Administrator may certificate the airplane as a type under the provisions of Part 4a which were in effect prior to November 9, 1945.

(c) Unless otherwise specified, an amendment to this part will apply only to airplanes for which application for a type certificate has been received subsequent to the effective date of such amendment.

(d) All aircraft certificated under the transport category, the manufacture of which is completed after September 30, 1947, shall comply with the following sections of this part: §§ 4b.58, 4b.442, 4b.445 (a), 4b.447, 4b.448 (b), 4b.448 (c), 4b.478, 48.484, 4b.503 (c), 4b.516 through 4b.518, 4b.556, 4b.557, 4b.560, 4b.561, 4b.586–4b.595, 4b.621–4b.624, 4b.651–4b.655, 4b.661, and 4b.662–4b.676.

[Amdt. 04–0, 11 F. R. 71 as amended by Amdt. 04–1, 11 F. R. 11351, Amdt. 04b–7, 12 F. R. 5960]

§ 4b.6 *Airplane categories.* In this part airplanes are divided upon the basis of their intended operation into the following categories for the purposes of certification:

(a) *Transport.* Airplanes in this category must be multiengine, are limited to non-acrobatic operation, and intended for, but not limited to, scheduled passenger, cargo, or combined passenger and cargo carrying operation.

(b) *Restricted.* Airplanes in this category are intended to be operated for restricted purposes not logically encompassed by the transport category. The requirements of this category shall consist of all the provisions for the transport category which are not rendered inapplicable by the nature of the special purpose involved, plus suitable operating restrictions which the Administrator finds will provide a level of safety equivalent to that contemplated for the transport category.

AIRWORTHINESS CERTIFICATES

§ 4b.11 *Classification.* Airworthiness certificates are classified as follows:

(a) *NC (standard) certificates.* In order to become eligible for an NC (standard) certificate, the airplane must be shown to comply with all of the requirements contained in this part for at least one category, but not the restricted-purpose category.

(b) *NR (restricted) certificates.* In order to become eligible for an NR (restricted) certificate, an airplane must be shown to comply with all of the requirements of the restricted purpose category.

(c) *NX (experimental) certificates.* An airplane will become eligible for an NX (experimental) certificate when the applicant presents satisfactory evidence that the airplane is to be flown for experimental purposes and the Administrator finds it may, with appropriate restrictions, be operated for that purpose in a manner which does not endanger the general public. The applicant shall submit sufficient data such as photographs to identify the airplane satisfactorily and, upon inspection of the airplane, any pertinent information found necessary by the Administrator to safeguard the general public.

§ 4b.12 *Eligibility.* An airplane manufactured in accordance with a type certificate (see §§ 4b.15–4b.19) and conforming with the type design will become eligible for an airworthiness certificate when, upon inspection of the airplane, the Administrator determines it so to conform and that the airplane is in a condition for safe operation. For each newly manufactured airplane this determination shall include a flight check by the applicant.

[Amdt. 04–0, 11 F. R. 71, as amended by Amdt. 04b–10, 13 F. R. 2966]

TYPE CERTIFICATES

§ 4b.15 *Requirements for issuance.* A type certificate will be issued when the requirements of §§ 4b.16–4b.19 are met.

§ 4b.16 *Data required for NC (standard) and NR (restricted) certification.* The applicant for a type certificate shall submit to the Administrator the following:

(a) Such descriptive data, test reports, and computations as are necessary to demonstrate that the airplane complies with the airworthiness requirements. The descriptive data shall be known as the type design and shall consist of drawings and specifications disclosing the configuration of the airplane and all design features covered in the airworthiness requirements as well as sufficient information on dimensions, materials, and processes to define the strength of the structure. The type design shall describe the airplane in sufficient detail to permit the airworthiness of subsequent airplanes of the same type to be determined by comparison with the type design.

[Amdt. 04–0, 11 F. R. 71, as amended by Amdt. 04b–10, 13 F. R. 2966]

§ 4b.17 *Inspection and tests for NC (standard) and NR (restricted) certification.* The authorized representatives of the Administrator shall have access to the airplane and may witness or conduct such inspections and tests as are necessary to insure compliance with the airworthiness requirements.

[Amdt. 04–0, 11 F. R. 71, as amended by Amdt. 04b–10, 13 F. R. 2966]

§ 4b.18 *Inspection.* Inspections and tests shall include all those found necessary by the Administrator to insure that the airplane conforms with the following:

(a) All materials and products are in accordance with the specifications given in the type design.

(b) All parts of the airplane are constructed in accordance with the drawings contained in the type design.

(c) All manufacturing processes, construction, and assembly are such that the design strength and safety contemplated by the type design will be realized in service.

§ 4b.19 *Flight tests.* (Applicable to all airplanes certificated as a type on or after May 15, 1947.) After proof of compliance with the structural requirements contained in this part, and upon completion of all necessary inspection and testing on the ground, and proof of the conformity of the airplane with the type design, and upon receipt from the applicant of a report of flight tests conducted by him, there shall be conducted such official flight tests as the Administrator finds necessary to determine compliance with Subparts B–G. After the conclusion of these flight tests such additional flight tests shall be conducted as the Administrator finds necessary to ascertain whether there is reasonable assurance that the airplane, its components, and equipment are reliable and function properly. The extent of such additional flight tests shall depend upon the complexity of the airplane, the number and nature of new design features, and the record of previous tests and experience for the particular airplane model, its components, and equipment. If practicable, the flight tests performed for the purpose of ascertaining the reliability and proper functioning shall be conducted on the same airplane which was used in flight tests to show compliance with Subparts B–G.

[Amdt. 04b–3, 12 F. R. 1029, as amended by Amdt. 04b–4, 12 F. R. 2087]

CHANGES

§ 4b.26 *Continued compliance.* Changes shall be substantiated to demonstrate continued compliance of the airplane with the appropriate airworthiness requirements in effect when the particular airplane was certificated as a type unless the applicant chooses to show compliance with the currently effective requirements subject to the approval of the Administrator or unless the Administrator finds it necessary to comply with current airworthiness requirements.

§ 4b.27 *Minor changes.* Minor changes to certificated airplanes which obviously do not impair the condition of the airplane for safe operation shall be approved by the authorized representatives of the Administrator prior to the submittal to the Administrator of any required revised drawings.

§ 4b.28 *Major changes.* A major change is any change not covered by minor changes as defined in § 4b.27.

§ 4b.29 *Service experience changes.* When the Administrator finds that service experience indicates the need for design changes, the applicant shall submit for the approval of the Administrator engineering data describing and substantiating the necessary changes. Upon approval by the Administrator, these changes shall be considered as a part of the type design, and descriptive data covering these changes shall be furnished by the applicant to all aircraft owners concerned.

§ 4b.30 *Current compliance.* In the case of airplanes approved as a type under the terms of earlier airworthiness requirements, the Administrator may require that an airplane submitted for an original airworthiness certificate comply with such portions of the currently effective airworthiness requirements as may be necessary for safety.

APPROVAL OF MATERIALS, PARTS, PROCESSES, AND APPLIANCES

§ 4b.41 *Specifications.* (a) Materials, parts, processes, and appliances shall be approved upon a basis and in a manner found necessary by the Administrator to implement the pertinent provisions of the Civil Air Regulations. The Administrator may adopt and publish such specifications as he finds necessary to administer this section, and shall incorporate therein such portions of the aviation industry, Federal, and military specifications respecting such materials, parts, processes, and appliances as he finds appropriate.

(b) Any material, part, process, or appliance shall be deemed to have met the requirements for approval when it meets the pertinent specifications adopted by the Administrator, and the manufacturer so certifies in a manner prescribed by the Administrator.

[Amdt. 04b-8, 12 F. R. 7898]

DEFINITIONS

§ 4b.51 *Standard atmosphere.* The standard atmosphere shall be based upon the following assumptions:

(a) The air is a dry perfect gas.

(b) The temperature at sea level is 59° F.

(c) The pressure at sea level is 29.92 inches Hg.

(d) The temperature gradient from sea level to the altitude at which the temperature becomes −67° F. is −0.003566° F. per foot, and zero thereabove.

(e) The density, ρ_0, at sea level under the above conditions is 0.002378 lbs. sec.²/ft.⁴.

§ 4b.52 *Hot-day condition.* (See § 4b.577.)

§ 4b.53 *Airplane configuration.* This term refers to the position of the various elements affecting the aerodynamic characteristics of the airplane, such as landing gear, flaps, etc.

§ 4b.54 *Weights.*

	Reference sections
Empty weight: The actual weight used as a basis for determining operating weights	4b. 83
Maximum weight: The maximum weight at which the airplane may operate in accordance with the airworthiness requirements	4b. 84
Minimum weight: The minimum weight at which compliance with the airworthiness requirements is demonstrated	4b. 85
Design take-off weight: The maximum weight used in the structural design of the airplane for flight conditions, special landing conditions with reduced descent velocity (§ 4b.243 (a) (2)), and taxying conditions	4b. 186
Design landing weight: The maximum weight used in the structural design of the airplane for normal landing conditions	4b. 242
Minimum design weight: The minimum weight condition investigated in the structural flight load conditions not greater than the minimum weight specified in § 4b.85. Minimum weight	4b. 186

Unit weights for design purposes:

Gasoline	6 pounds per United States gallon.
Lubricating oil	7.5 pounds per United States gallon.
Crew and passengers	170 pounds per person.

§ 4b.55 *Power.*—(a) *One horsepower.* 33,000 foot-pounds per minute.

(b) *Take-off power.* The take-off rating of the engine established in accordance with Part 13, Aircraft Engine Airworthiness, of this chapter.

(c) *Maximum continuous power.* The maximum continuous rating of the engine established in accordance with Part 13, Aircraft Engine Airworthiness, of this chapter.

§ 4b.56 *Speeds.*

V_t True air speed of the airplane relative to the undisturbed air.

In the following symbols having subscripts, V denotes

(a) "Equivalent" air speed for structural design purposes equal to $V_t\sqrt{\rho/\rho_0}=V_t\sqrt{\sigma}$

(b) "True indicated" or "calibrated" air speed for performance and operating purposes equal to indicator reading corrected for position and instrument errors.

	Reference sections
V_{s_0} stalling speed, in the landing configuration	4b. 93
V_{s_1} stalling speed in the configuration specified for particular conditions	4b. 93
V_{mc} minimum control speed	4b. 129
V_f design speed for flight load conditions with flaps in the landing position	4b. 189
V_p design maneuvering speed	4b. 189
V_b design speed for 40 feet per second gust	4b. 189
V_c design cruising speed	4b. 189
V_d design dive speed	4b. 189
V_{ne} never exceed speed	4b. 850
Maximum structural cruising speed	4b. 851

§ 4b.57 *Structural terms.*

Structure: Those portions of the airplane the failure of which would seriously endanger the safety of the airplane.

Design wing area, *S:* The area enclosed by the wing outline (including ailerons, and flaps in the retracted position, but ignoring fillets and fairings) on a surface containing the wing chords. The outline is assumed to extend through the nacelles and fuselage to the plane of symmetry.

Aerodynamic coefficients, C_L, C_N, C_M, etc., used in this part, are nondimensional coefficients for the forces and moments acting on an airfoil, and correspond to those adopted by the U. S. National Advisory Committee for Aeronautics.

C_L = airfoil lift coefficient.

C_N = airfoil normal force coefficient (normal to wing chord line).

C_{NA} = airplane normal force coefficient (based on lift of complete airplane and design wing area).

C_M = pitching moment coefficient.

Loads	*Reference sections*
Limit load: The maximum load anticipated in service	4b. 176
Ultimate load: The maximum load which a part or structure must be capable of supporting	4b. 178
Factor of safety: The factor by which the limit load must be multiplied to establish the ultimate load	4b. 177

Load factor or acceleration factor, *n:* The ratio of the force acting on a mass to the weight of the mass. When the force in question represents the net external load acting on the airplane in a given direction, *n* represents the acceleration in that direction in terms of the gravitational constant.

Limit load factor: The load factor corresponding to limit load.

Ultimate load factor: The load factor corresponding to ultimate load.

§ 4b.58 *Susceptibility of materials to fire.* Where necessary for the purpose of determining compliance with any of the definitions in this section, the Administrator shall prescribe the heat conditions and testing procedures which any specific material or individual part must meet.

(a) *Fireproof.* "Fireproof" material means a material which will withstand heat equally well or better than steel in dimensions appropriate for the purpose for which it is to be used. When applied to material and parts used to confine fires in designated fire zones "fireproof" means that the material or part will perform this function under the most severe conditions of fire and duration likely to occur in such zones.

(b) *Fire-resistant.* When applied to sheet or structural members, "fire-resistant" material shall mean a material which will withstand heat equally well or better than aluminum alloy in dimensions appropriate for the purpose for which it is to be used. When applied to fluid-carrying lines, this term refers to a line and fitting assembly which will perform its intended protective functions under the heat and other conditions likely to occur at the particular location.

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

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

(e) *Inflammable.* "Inflammable" fluids or gases means those which will ignite readily or explode.

[Amdt. 04-1, 11 F. R. 11351]

§ 4b.58-1 *Fire-resistant aircraft material (CAA rules which apply to § 4b.58).* See § 4b.448-3.

[13 F. R. 7726]

SUBPART B—FLIGHT REQUIREMENTS

GENERAL

§ 4b.71 *Policy re proof of compliance.* Compliance with the requirements specified in this subpart governing functional characteristics shall be demonstrated by suitable flight or other tests conducted upon an airplane of the type, or by calculations based upon the test data referred to above: *Provided,* That the results so obtained are substantially equal in accuracy to the results of direct testing. Compliance with each requirement must be provided at the critical combination of airplane weight and center of gravity position, within the range of either, for which certification is desired for each practicably separable operating condition to which the requirement is applicable. Such compliance must be demonstrated by systematic investigation of all probable weight and center of gravity combinations or must be reasonably inferable from such as are investigated.

§ 4b.72 *Flight test pilot.* The applicant shall provide a person holding an appropriate pilot certificate to make the flight tests, but a designated representative of the Administrator may pilot the airplane insofar as that may be necessary for the determination of compliance with the airworthiness requirements.

§ 4b.73 *Noncompliance with test requirements.* Official type tests will be discontinued until corrective measures have been taken by the applicant when either:

(a) The applicant's test pilot is unable or unwilling to conduct any of the required flight tests; or,

(b) Items of noncompliance with requirements are found which may render additional test data meaningless or are of such nature as to make further testing unduly hazardous.

§ 4b.74 *Emergency egress.* Adequate provisions shall be made for emergency egress and use of parachutes by members of the crew during the flight tests.

§ 4b.75 *Report.* The applicant shall submit to the representative of the Administrator a report covering all computations and tests required in connection with calibration of instruments used for test purposes and correction of test results to standard atmospheric conditions. The representative of the Administrator will conduct any flight tests which appear to him to be necessary in order to check the calibration and correction report.

Weight Range and Center of Gravity

§ 4b.81 *Weight and balance.* There shall be established, as a part of the type inspection, ranges of weight and center of gravity within which the airplane may be safely operated.

§ 4b.82 *Use of ballast.* Removable ballast may be used to enable airplanes to comply with the flight requirements in accordance with the following provisions:

(a) The place or places for carrying ballast shall be properly designed, installed, and plainly marked as specified in § 4b.901.

(b) The airplane operating manual shall include instructions regarding the proper disposition of the removable ballast under all loading conditions for which such ballast is necessary, as specified in § 4b.916 (c).

§ 4b.83 *Empty weight.* The empty weight and corresponding center of gravity location shall include all fixed ballast, the unusable fuel supply (see § 4b.494), undrainable oil, full engine coolant, and hydraulic fluid. The weight and location of items of equipment installed in the airplane when weighed shall be noted in the operating manual.

§ 4b.84 *Maximum weight.* (a) The maximum landing and take-off weights shall not exceed any of the following:

(1) The weights selected by the applicant,

(2) The design weights for which the structure has been proven,

(3) The maximum weights at which compliance with all of the applicable requirements specified is demonstrated.

(b) The maximum take-off weight and the maximum landing weight may be made variable with altitude.

§ 4b.85 *Minimum weight.* The minimum weight shall not be less than any of the following:

(a) The minimum weight selected by the applicant,

(b) The minimum design weight for which the structure has been proven,

(c) The minimum weight at which compliance with all the applicable requirements herein specified is demonstrated.

§ 4b.86 *Center of gravity position.* The fore and aft extremes of center of gravity position shall not exceed any of the following:

(a) The extremes selected by the applicant,

(b) The extremes for which the structure has been proven,

(c) The extremes at which compliance with all applicable flight requirements is demonstrated.

Performance Requirements

General

§ 4b.91 *Performance.* The items of performance set forth in §§ 4b.92–4b.114 shall be determined and the airplane shall comply with the corresponding requirements in the standard atmosphere and still air. The wing flap positions denoted respectively as the take-off, en route, approach, and landing positions shall be selected by the applicant and may be made variable with weight and altitude (see § 4b.354).

§ 4b.92 *Minimum requirements for certification.* An airplane may be certificated upon having established:

(a) A maximum take-off weight at sea level (see § 4b.84),

(b) A maximum landing weight at sea level (see § 4b.84),

(c) Compliance with the climb requirement of §4b.103 (b),

(d) Take-off data at maximum sea level take-off weight, and landing data at maximum sea level landing weight, in accordance with §§ 4b.94–4b.97 (Take-off), and §§ 4b.111–4b.114 (Landing),

(e) Compliance with the requirements of all other applicable parts of this chapter.

§ 4b.93 *Definition of stalling speeds.* (a) V_{s_0} denotes the true indicated stalling speed, or the minimum steady flight speed at which the airplane is controllable, in miles per hour, with:

(1) Engines idling, throttles closed (or not more than sufficient power for zero thrust set at a speed not greater than 110 percent of the stalling speed),

(2) Propellers in position normally used for take-off,

(3) Landing gear extended,

(4) Wing flaps in the landing position,

(5) Cowl flaps closed,

(6) Center of gravity in the most unfavorable position within the allowable landing range,

(7) The weight of the airplane equal to the weight in connection with which V_{s_0} is being used as a factor to determine a required performance.

(b) V_{s_1} denotes the true indicated stalling speed, or the minimum steady flight speed at which the airplane is controllable, in miles per hour, with:

(1) All engines idling, throttles closed (or not more than sufficent power for zero thrust set at a speed not greater than 110 percent of the stalling speed),

(2) Propellers in position normally used for take-off, the airplane in all other respects (flaps, landing gear, etc.,) in the particular condition existing in the particular test in connection with which V_{s_1} is being used,

(3) The weight of the airplane equal to the weight in connection with which V_{s_1} is being used as a factor to determine a required performance.

(c) These speeds shall be determined by flight tests using the procedure outlined in § 4b.151 (a).

Take-off

§ 4b.94 *Take-off data.* (a) The take-off data set forth in §§ 4b.95–4b.97 shall be determined:

(1) At all weights and altitudes desired by the applicant,

(2) With a constant take-off flap position for a particular weight and altitude,

(3) With the operating engines not exceeding their approved limitations at the particular altitude.

(b) These data, when corrected, shall assume a level take-off surface. All take-off data shall be determined on a smooth, dry, hard surfaced runway and in such a manner that reproduction of such data does not require exceptional skill or alertness on the part of the pilot.

§ 4b.95 *Speeds.* (a) The critical engine failure speed, V_1, is a true indicated air speed, chosen by the applicant, which shall not be less than the minimum speed at which the controllability is demonstrated during take-off run to be adequate to permit proceeding safely with the take-off, using normal piloting skill, when the critical engine is suddenly made inoperative. If V_1 is equal to or greater than V_2 below, no demonstration during take-off is required.

(b) The minimum take-off climb speed, V_2, is a true indicated air speed chosen by the applicant which shall permit the rate of climb required in § 4b.103 (a) but which shall not be less than:

(1) 1.20 V_{s_1} for two-engine airplanes,

(2) 1.15 V_{s_1} for airplanes having more than two engines,

(3) 1.10 times the minimum control speed, V_{mc}, established under § 4b.129 (Minimum control speed).

§ 4b.96 *Accelerate-stop distance.* The distance required to accelerate the airplane from a standing start to the speed, V_1, and, assuming an engine to fail at this point, to stop.

Means other than wheel brakes may be used in determining this distance providing that exceptional skill is not required to control the airplane, that the manner of their employment is such that consistent results could be expected under normal service, and that they are regarded as reliable.

§ 4b.96–1 *Reverse thrust used in establishing accelerate-stop distance (CAA policies which apply to § 4b.96).* The Administrator will permit the use of reverse thrust, in combination with the brakes installed, in establishing the accelerate-stop distance, only if it can be shown that such use provides a level of safety equivalent to that contemplated by the present regulations when wheel brakes alone are used, including proper consideration of pilot skill required and likelihood of attaining the necessary performance under conditions of simulated engine failure.

[12 F. R. 3438. Correction noted at 14 F. R. 37]

§ 4b.97 *Take-off path.* (a) The distance required to accelerate the airplane to the speed, V_2, making the critical engine inoperative at the speed, V_1.

(b) The horizontal distance traversed and the height attained by the airplane in the time required to retract the landing gear when operating at the speed, V_2, with:

(1) The critical engine inoperative, its propeller windmilling with the propeller control in a position normally used during take-off,

(2) The landing gear extended.

(c) The horizontal distance traversed and the height attained by the airplane in the time elapsed from the end of element (b) until the rotation of the inoperative propeller has been stopped when:

(1) The operation of stopping the propeller is initiated not earlier than the instant the airplane has attained a total height of 50 feet above the take-off surface,

(2) The airplane speed is equal to V_2,

(3) The landing gear is retracted,

(4) The inoperative propeller is windmilling with the propeller control in a position normally used during take-off.

(d) The horizontal distance traversed and the height attained by the airplane in the time elapsed from the end of element (c) until the limit on the use of take-off power is reached, while operating at the speed, V_2, with:

(1) The inoperative propeller stopped,

(2) The landing gear retracted.

(e) The slope of the flight path followed by the airplane in the configuration of element (d), but drawing not more than maximum continuous power on the operating engine(s).

CLIMB

§ 4b.101 *Requirements.* Compliance shall be shown with the requirements set forth in §§ 4b.102–4b.104.

§ 4b.102 *All engines operating*—(a) *Flaps in en route position.* The steady rate of climb at 5,000 feet shall not be less in feet per minute than 8 V_{s_0} with:

(1) Landing gear fully retracted,

(2) Wing flaps in the most favorable position,

(3) Cowl flaps in the position which provides adequate cooling in the hot-day condition,

(4) Center of gravity in the most unfavorable position,

(5) All engines operating at not more than maximum continuous power,

(6) Maximum take-off weight.

The steady rate of climb shall also be determined at any altitude at which the airplane may be expected to operate at any weight within the range of weights to be specified in the airworthiness certificate.

(b) *Flaps in landing position.* The steady rate of climb in feet per minute shall be at least 0.07 $V_{s_0}^2$ at any altitude within the range for which landing weight is to be specified in the certificate, with:

(1) Landing gear extended,

(2) Wing flaps in the landing position (see §§ 4b.91 and 4b.354),

(3) Cowl flaps in the position normally used in an approach to a landing,

(4) Center of gravity in the most unfavorable position permitted for landing,

(5) All engines operating at the take-off power available at such altitude,

(6) The weight equal to maximum landing weight for that altitude.

§ 4b.103 *One engine inoperative*—(a) *Flaps in take-off position.* The steady rate of climb in feet per minute shall be at least 0.035 $V_{s_1}^2$ at any altitude within the range for which take-off weight is to be specified in the certificate, with:

(1) The landing gear retracted,

(2) Wing flaps in the take-off position (see §§ 4b.91 and 4b.354),

(3) Cowl flaps in the position normally used during take-off,

(4) Center of gravity in the most unfavorable position permitted for take-off,

(5) The critical engine inoperative, its propeller windmilling with the propeller control in a position normally used during take-off,

(6) All other engines operating at the take-off power available at such altitude,

(7) The speed equal to the minimum take-off climb speed, V_2, used in § 4b.95 (b),

(8) The weight equal to maximum take-off weight for that altitude.

(9) With the landing gear extended and all other conditions as described in paragraph (a) of this section, the rate of climb shall be at least 50 feet per minute.

(b) *Flaps in en route position.* The steady rate of climb in feet per minute at any altitude at which the airplane may be expected to operate, at any weight within the range of weights to be specified in the airworthiness certificate, shall be determined and shall, at a standard altitude of 5,000 feet and at the maximum take-off weight, be at least 0.02 $V_{s_0}^2$ for airplanes with a maximum take-off weight of 40,000 lbs. or less, 0.04 $V_{s_0}^2$ for airplanes with a maximum take-off weight of 60,000 lbs. or more, with a linear variation between 40,000 lbs. and 60,000 lbs., with:

(1) The landing gear retracted,

(2) Wing flaps in the most favorable position,

(3) Cowl flaps or other means of controlling the engine cooling air supply in the position which provides adequate cooling in the hot-day condition,

(4) Center of gravity in the most unfavorable position,

(5) The critical engine inoperative, its propeller stopped,

(6) All remaining engines operating at the maximum continuous power available at the altitude.

(c) *Flaps in approach position.* The steady rate of climb in feet per minute shall not be less than 0.04 $V_{s_0}^2$ at any altitude within the range for which landing weight is to be specified in the certificate, with:

(1) The landing gear retracted,

(2) Wing flaps set in position such that V_{s_1} does not exceed 1.10 V_{s_0},

(3) Cowl flaps in the position normally used during an approach to a landing,

(4) Center of gravity in the most unfavorable position permitted for landing,

(5) The critical engine inoperative, its propeller stopped,

(6) All remaining engines operating at the take-off power available at such altitude,

(7) The weight equal to the maximum landing weight for that altitude.

[Amdt. 04-0, 11 F. R. 71, as amended by Amdt. 4b-11, 14 F. R. 2587]

§ 4b.104 *Two engines inoperative.* For airplanes with four or more engines, the steady rate of climb at any altitude at which the airplane may be expected to operate and at any weight within the range of weights to be specified in the operating manual, shall be determined with:

(a) The landing gear retracted,

(b) Wing flaps in the most favorable position,

(c) Cowl flaps or other means of controlling the engine cooling air supply in the position which will provide adequate cooling in the hot-day condition,

(d) Center of gravity in the most unfavorable position,

(e) The two critical engines on one side of the airplane inoperative and their propellers stopped,

(f) All remaining engines operating at the maximum continuous power available at that altitude.

LANDING

§ 4b.111 *Distance.* The horizontal distance required to land and to come to a complete stop (to a speed of approximately 3 miles per hour for seaplanes or float planes) from a point at a height of 50 feet above the landing surface shall be determined for such range of weights and altitudes as the applicant may desire. In making this determination:

(a) Immediately prior to reaching the 50-foot altitude a steady gliding approach shall have been maintained, with a true indicated air speed of at least 1.3 V_{s_0}.

(b) The nose of the airplane shall not be depressed, nor the forward thrust increased by application of power after reaching the 50-foot altitude. At all times during and immediately prior to the landing, the flaps shall be in the landing position, except that after the airplane is on the landing surface and the true indicated air speed has been reduced to not more than 0.9 V_{s_0} the flap position may be changed.

(c) The landing shall be made in such manner that there is no excessive vertical acceleration, no tendency to bounce, nose over, ground loop, porpoise or water loop, and in such manner that its reproduction shall not require any exceptional degree of skill on the part of the pilot, or exceptionally favorable conditions.

§ 4b.112 *Landplanes.* The landing distance as defined in § 4b.111 shall be determined on a dry hard surfaced runway and:

(a) The operating pressures on the braking system shall not be in excess of those approved by the manufacturer of the brakes.

(b) The brakes shall not be used in such manner as to produce excessive wear of brakes or tires.

(c) Means other than wheel brakes may be used in determining the landing distance providing that exceptional skill is not required to control the airplane, that the manner of their employment is such that consistent results could be expected under normal service, and that they are regarded as reliable.

§ 4b.112-1 *Landing distances (CAA policies which apply to § 4b.112 (c)).* See § 3.86-1 of this chapter.

[12 F. R. 3438. Correction noted at 14 F. R. 87]

§ 4b.113 *Seaplanes or float planes.* The landing distance as defined in § 4b.111 shall be determined on smooth water.

§ 4b.114 *Skiplanes.* The landing distance as defined in § 4b.111 shall be determined on smooth, dry snow.

FLIGHT CHARACTERISTICS

§ 4b.121 *Requirements.* The airplane shall meet the requirements set forth in §§ 4b.126–4b.129 at all normally expected operating altitudes under all critical loading conditions within the range of center of gravity appropriate thereto and, except as otherwise specified, at the maximum weight for which certification is sought, and there shall be no flight or operating characteristic which makes the airplane unairworthy.

CONTROLLABILITY

§ 4b.126 *General.* The airplane shall be safely controllable and maneuverable during take-off, climb, level flight, dive, and landing, and it shall be possible to make a smooth transition from one flight condition to another, including turns and slips, without requiring an exceptional degree of skill, alertness, or strength on the part of the pilot and without danger of exceeding the limit load factor under all conditions of operation probable for the type, including those conditions normally encountered in the event of sudden failure of any engine. The airplane shall be demonstrated to comply with the provisions of §§ 4b.127–4b.129.

§ 4b.127 *Longitudinal control.* (a) When a tail wheel landing gear is used it shall be possible during take-off ground run, to maintain any attitude up to thrust line level at 80 percent V_{s_1} when running on a concrete runway.

(b) It shall be possible at all speeds between 1.4 V_{s_1} and V_{s_1} to pitch the nose downward so that the rate of increase in air speed is satisfactory for prompt acceleration to a speed equal to 1.4 V_{s_1} with:

(1) The airplane trimmed at 1.4 V_{s_1} with landing gear extended,

(2) The wing flaps in a retracted and extended position,

(3) Power off and maximum continuous power on all engines.

(c) During each of the controllability demonstrations outlined below, it shall not require a change in the trim control or the exertion of more control force than can be readily applied with one hand for a short period. Each maneuver shall be performed with the landing gear extended.

(1) (i) With power off, flaps retracted, and the airplane trimmed at 1.4 V_{s_1}, the flaps are to be extended as rapidly as possible while maintaining the air speed at an adequate margin of approximately 40 percent above the stalling speed.

(ii) Repeat (1) (i) except start with flaps extended and the airplane trimmed at 1.4 V_{s_1}, then retract the flaps as rapidly as possible.

(iii) Repeat (1) (i) except using maximum continuous power.

(iv) Repeat (1) (ii) except using maximum continuous power.

(2) (i) With power off, the flaps retracted, and the airplane trimmed at 1.4 V_{s_1}, apply take-off power quickly while maintaining the same air speed.

(ii) Repeat (2) (i) except with the flaps extended.

(3) With power off, flaps extended, and the airplane trimmed at 1.4 V_{s_1}, obtain and maintain air speeds within the range of 1.1 V_{s_1} to 1.7 V_{s_1} or to the flap placard speed, whichever is greater.

(d) It shall be possible without the use of exceptional piloting skill to prevent loss of altitude when flap retraction from any position is initiated during steady horizontal flight at 1.1 V_{s_1} with simultaneous application of not more than maximum continuous power.

§ 4b.128 *Lateral and directional control.* (a) It shall be possible to execute 20-degree banked turns with or against the inoperative engine from steady climb at a speed equal to 1.4 V_{s_1}, with:

(1) The critical engine inoperative and its propeller in the minimum drag condition,

(2) Maximum continuous power on the operating engines,

(3) Most unfavorable center of gravity,

(4) Landing gear retracted and extended,

(5) Wing flaps in the most favorable climb position,

(6) Maximum take-off weight.

(b) In the configuration outlined in paragraph (a) of this section, it shall be possible, while holding the wings level laterally, to execute sudden changes in heading in either direction without dangerous characteristics being encountered. This shall be demonstrated at a speed equal to 1.4 V_{s_1} at landing weight, approach flaps, one engine inoperative, gear retracted, and power for level flight at 1.4 V_{s_1}, up to heading changes of 15°, except that the heading change at which the rudder pedal force is 180 pounds need not be exceeded.

(c) Airplanes with four or more engines installed shall comply with paragraphs (a) and (b) of this section with the two critical engines inoperative, at an airplane weight at which the rate of climb is equal to at least .01 $V_{s_0}{}^2$ at an altitude of 5,000 feet with the landing gear retracted and the wing flaps in the most favorable position.

§ 4b.129 *Minimum control speed.* (V_{mc}). (a) The minimum speed after recovery at which the airplane can be maintained in straight flight with zero yaw (or, at the option of the applicant, with a bank not in excess of 5°) after any one engine is suddenly made inoperative during steady flight at that speed, shall be determined and shall not exceed 1.2 V_{s_1} with:

(1) Take-off or maximum available power in all engines,

(2) Rearmost center of gravity,

(3) Flaps in take-off position,

(4) Landing gear retracted.

(b) In demonstrating this minimum speed, the rudder force required to maintain it shall not exceed 180 pounds, nor shall it be necessary to throttle the remaining engines. During recovery the airplane shall not assume any dangerous attitude, nor shall it require exceptional skill, strength, or alertness on the part of the pilot to prevent a change of heading in excess of 20° before recovery is complete.

TRIM

§ 4b.136 *Requirements.* The means used for trimming the airplane shall be such that after being trimmed and without further pressure upon or movement of either the primary control or its corresponding trim control by the pilot or the automatic pilot, the airplane will maintain:

(a) Lateral and directional trim under all conditions of operation consistent with the intended use of the airplane including operation at any speed from 1.4 V_{s_1} to at least 90 percent of high speed and operation in which there is greatest lateral variation in the distribution of the useful load.

(b) Longitudinal trim under the following conditions:

(1) During a climb with maximum continuous power at a speed not in excess of 1.4 V_{s_1} with the landing gear retracted and the wing flaps both retracted and in the take-off position.

(2) During a glide with power off at a speed not in excess of 1.4 V_{s_1}, with the landing gear extended and the wing flaps both retracted and extended under the forward center of gravity position approved for landing with the maximum landing weight and under the most forward center of gravity position approved for landing, regardless of weight.

(3) During level flight at any speed from 1.4 V_{s_1} to 90 percent of the high speed with the landing gear both retracted and extended and wing flaps retracted.

(c) Longitudinal and directional trim at a speed equal to 1.4 V_{s_1}, during climbing flight with the critical engine inoperative, with:

(1) The other engine(s) at maximum continuous power,

(2) The landing gear retracted,

(3) Wing flaps retracted.

(d) Rectilinear flight at the climb speed, configuration, and power used in establishing the rates of climb in § 4b.104, the most unfavorable center of gravity position, and the weight at which the two-engine inoperative climb is equal to at least .01 $V_{s_1}{}^2$ at an altitude of 5,000 feet.

STABILITY

§ 4b.141 *General.* The airplane shall be longitudinally, directionally, and laterally stable in accordance with §§ 4b.142–4b.145. Suitable stability and control "feel" (static stability) may be required in other conditions normally encountered in service if flight tests show such stability to be necessary for safe operation.

§ 4b.142 *Static longitudinal stability.* In the configurations outlined in § 4b.143, and with the airplane trimmed as indicated, the characteristics of the elevator control forces and friction shall be as described in paragraphs (a) and (b) of this section.

(a) A pull shall be required to obtain and maintain speeds below the specified trim speed and a push to obtain and maintain speeds above the specified trim speed. This shall be so at any speed which can be obtained without excessive control force except that such speeds need not be greater than the appropriate maximum permissible speed or less than the minimum speed in steady unstalled flight.

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

§ 4b.143 *Specific conditions.* In paragraphs (a), (b) and (c) of this section, within the speeds specified, the stable slope of stick force curve versus speed shall be such that any substantial change in speed is clearly perceptible to the pilot through a resulting change in stick force.

(a) *Landing.* The stick force curve shall have a stable slope and the stick force shall not exceed 80 pounds at any speed between 1.1 V_{s_1} and 1.8 V_{s_1} with:

(1) Wing flaps in the landing position,

(2) The landing gear extended,

(3) Maximum sea level landing weight,

(4) Throttles closed on all engines,

(5) The airplane trimmed at 1.4 V_{s_1} with throttles closed.

(b) *Approach.* The stick force curve shall have a stable slope at all speeds between 1.1 V_{s_1} and 1.8 V_{s_1} with:

(1) Wing flaps in sea level approach position,

(2) Landing gear retracted,

(3) Maximum sea level landing weight,

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

(c) *Climb.* The stick force curve shall have a stable slope at all speeds between 1.2 V_{s_1} and 1.6 V_{s_1} with:

(1) Wing flaps retracted,

(2) Landing gear retracted,

(3) Maximum sea level take-off weight,

(4) 75% of maximum continuous power,

(5) The airplane trimmed at 1.4 V_{s_1}.

(d) *Cruising.* (1) Between 1.3 V_{s_1} and the maximum permissible speed, the stick force curve shall have a stable slope at all speeds obtainable with a stick force not in excess of 50 pounds, with:

(i) Landing gear retracted,

(ii) Wing flaps retracted,

(iii) Maximum sea level take-off weight,

(iv) 75% of maximum continuous power,

(v) The airplane trimmed for level flight with 75% of the maximum continuous power.

(2) Same as subparagraph (1) of this paragraph except that the landing gear shall be extended and the level flight trim speed need not be exceeded.

§ 4b.144 *Dynamic longitudinal stability.* Any short period oscillation occurring between stalling speed and maximum permissible speed shall be heavily damped with the primary controls in (a) free, and (b) in a fixed position.

§ 4b.145 *Directional and lateral stability.* (a) The static directional stability, as shown by the tendency to recover from a skid with rudder free, shall be positive with all landing gear and flap positions and symmetrical power conditions, at all speeds from 1.2 V_{s_1} up to the maximum permissible speed.

(b) The static lateral stability, as shown by the tendency to raise the low wing in a sideslip, shall be positive within the same limits.

(c) In straight steady sideslips (unaccelerated forward slips), the aileron and rudder control movements and forces shall be substantially proportional to the angle of sideslip and the factor of proportionality shall lie between satisfactory limits up to sideslip angles considered appropriate to the operation of the type. At greater angles up to that at which the full rudder control is employed or a rudder pedal force of 180 pounds is obtained, the rudder pedal forces shall not reverse, and increased rudder deflection shall produce increased angles of sideslip.

(d) Sufficient bank shall accompany sideslipping to indicate adequately any departure from steady unyawed flight unless a yaw indicator is provided.

(e) Any short period oscillation occurring between stalling speed and maximum permissible speed shall be heavily damped with the primary controls in (1) free, and (2) in a fixed position.

STALLS

§ 4b.151 *Stalling demonstration.* (a) Stalls shall be demonstrated under two conditions:

(1) With power off,

(2) With that power necessary to maintain level flight at a speed of 1.6 V_{s_1} with flaps in approach position, landing gear retracted, maximum landing weight.

(b) In either condition it shall be possible, with flaps and landing gear in any position, center of gravity in the most unfavorable position for recovery and with appropriate airplane weights and the airplane in straight flight and in turns up to 30° bank, to produce and to correct roll and yaw by unreversed use of the aileron and rudder controls in the maneuver described below up to the time when the airplane pitches. In straight flight stalls the average amount of roll occurring between the initiation of the pitching movement and the completion of the recovery shall not exceed 20°. The roll following the stall during turning flight must not be so violent or extreme as to make it difficult, with normal piloting skill, to make a prompt recovery and regain control of the airplane.

(c) Clear and distinctive stall warning shall be apparent to the pilot at a speed at least 5% above the stalling speed, with flaps and landing gear in any position, both in straight and turning flight. The warning may be furnished either through the inherent aerodynamic qualities of the airplane, by a suitable instrument, or in any equivalent fashion which will give clearly distinguishable indications under all conditions of flight that are to be expected in air-line operations.

(d) In demonstrating these qualities, the order of events shall be:

(1) With trim controls adjusted for straight flight at a speed of 1.4 V_{s_1} reduce speed by means of the elevator control until the speed is steady at slightly above stalling speed; then,

(2) Pull elevator control back at a rate such that the airplane speed reduction does not exceed 1 mile per hour per second until a stall is produced as evidenced by an uncontrollable downward pitching motion of the airplane, or until the control reaches the stop. Normal use of the elevator control for recovery may be made after such pitching motion is unmistakably developed.

§ 4b.152 *Stall test; one engine inoperative.* The airplane shall be safely recoverable without applying power to the inoperative engine when stalled with:

(a) The critical engine inoperative,

(b) Flaps and landing gear retracted,

(c) The remaining engines operating at up to 75% of maximum continuous power, except that the power need not be greater than that at which the use of maximum control travel does not hold the wings laterally level. The operating engines may be throttled back during the recovery from the stall.

GROUND AND WATER CHARACTERISTICS

§ 4b.161 *Requirements.* All airplanes shall comply with the requirements of §§ 4b.162–4b.166.

§ 4b.162 *Longitudinal stability and control.* (a) There shall be no uncontrollable tendency for landplanes to nose over in any operating condition reasonably expected for the type or when rebound occurs during landing or take-off. Wheel brakes shall operate smoothly and shall exhibit no undue tendency to induce nosing over.

(b) Seaplanes shall exhibit no uncontrollable porpoising at any speed at which the airplane is normally operated on the water.

§ 4b.163 *Directional stability and control.* (a) There shall be no uncontrollable or dangerous looping tendency in 90° cross winds up to 0.2 V_{s_0} at any necessary speed upon the ground or water.

(b) All landplanes shall be demonstrated to be satisfactorily controllable with no exceptional degree of skill or alertness on the part of the pilot in power-off landings, at normal landing speed, during which brakes or engine power are not used to maintain a straight path.

(c) Means shall be provided for adequate directional control during taxying.

§ 4b.164 *Shock absorption.* The shock absorbing mechanism shall not produce damage to the structure when the airplane is taxied on the roughest ground which it is reasonable to expect the airplane to encounter in normal operation.

§ 4b.165 *Spray characteristics.* For seaplanes, spray during taxying, take-off, or landing shall at no time dangerously obscure the vision of the pilots nor produce damage to the propeller or other parts of the airplane.

§ 4b.166 *Critical cross wind.* There shall be established a critical cross component of wind velocity at which it has been demonstrated to be safe to take-off or land.

Flutter and Vibration

§ 4b.171 *Flutter and vibration.* All parts of the airplane shall be demonstrated to be free from flutter and excessive vibration under all speed and power conditions appropriate to the operation of the airplane up to at least the minimum value permitted for V_d in § 4b.189. There shall also be no buffeting condition in any normal flight condition severe enough to interfere with the satisfactory control of the airplane, or to cause excessive fatigue to the crew or structural damage. However, buffeting as stall warning is considered desirable, and discouragement of this type of buffeting is not intended.

Subpart C—Strength Requirements

General

§ 4b.176 *Loads.* Strength requirements are specified in terms of limit and ultimate loads. Limit loads are the maximum loads anticipated in service. Ultimate loads are equal to the limit loads multiplied by the factor of safety. When not otherwise described, loads specified are limit loads. Unless otherwise provided, the specified air, ground, and water loads shall be placed in equilibrium with inertia forces, considering all items of mass in the airplane. All such loads shall be distributed in a manner closely approximating or conservatively representing actual conditions. If deflections under load would significantly change the distribution of external or internal loads, such redistribution shall be taken into account.

§ 4b.177 *Factor of safety.* The factor of safety shall be 1.5 unless otherwise specified.

§ 4b.178 *Strength and deformations.* The structure shall be capable of supporting limit loads without suffering detrimental permanent deformations. At all loads up to limit loads the deformation shall be such as not to interfere with safe operation of the airplane. The structure shall be capable of supporting ultimate loads without failure for at least 3 seconds.

§ 4b.179 *Proof of structure.* Proof of compliance of the structure with the strength and deformation requirements of § 4b.178 shall be made for all critical loading conditions. Proof of compliance by means of structural analysis will be accepted only when the structure conforms with types for which experience has shown such methods to be reliable. In all other cases substantiating tests are required. In all cases certain portions of the structure must be tested as specified in Subpart D.

Flight Loads

§ 4b.186 *General.* Flight load requirements shall be complied with at critical altitudes within the range for which certification is desired, and at all weights between the minimum design weight and design take-off weight with any practicable distribution of disposable load within prescribed operating limitations stated in the airplane operating manual. (See Subpart G.)

§ 4b.187 *Definition of flight load factor.* The flight load factors specified represent the acceleration (in terms of the gravitational constant) normal to the assumed longitudinal axis of the airplane equal in magnitude and opposite in direction to the airplane inertia load factor at the center of gravity.

Symmetrical Flight Conditions (Flaps Retracted)

§ 4b.188 *General.* The strength requirements shall be met at all combinations of air speed and load factor on and within the boundaries of the *V–n* diagrams of Figures 4b–1 and 4b–2 which represent the envelopes of the flight loading conditions specified by the maneuvering and gust criteria of §§ 4b.190, 4b.191 and 4b.193. These diagrams will also be used in determining the airplane structural operating limitations as specified in Subpart G.

§ 4b.189 *Design air speeds.* The design air speeds shall be chosen by the

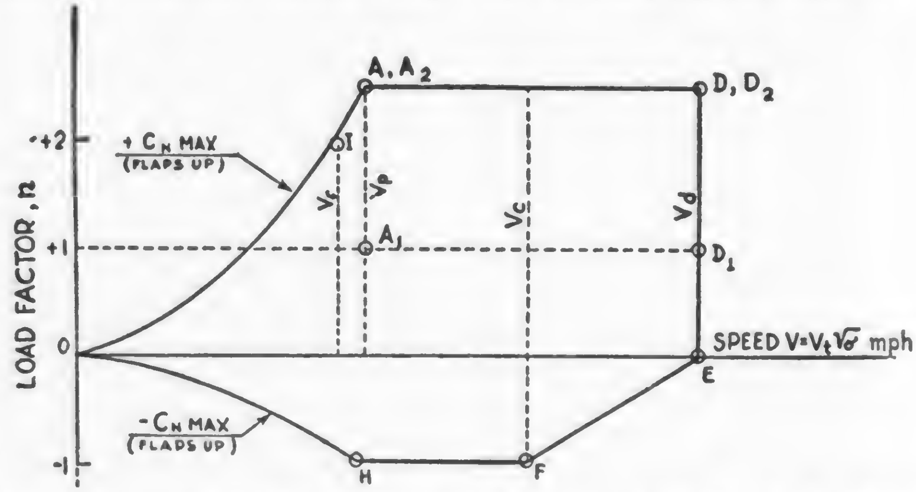


FIGURE 4b–1.—MANEUVERING ENVELOPE (see § 4b.190). LOAD FACTOR VS. VELOCITY (*V–n*) DIAGRAM.

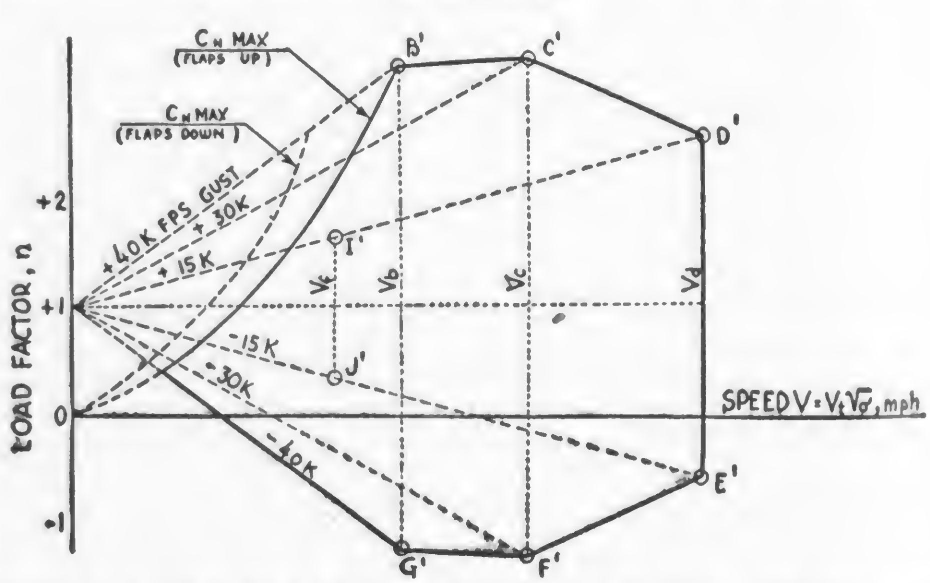


FIGURE 4b–2.—GUST ENVELOPE (see § 4b.191). LOAD FACTOR VS. VELOCITY (*V–n*) DIAGRAM.

designer except that they shall not be less than the following values:

V_f (design flap speed) $=1.4\ V_{s_1}$ or $1.8\ V_{s_0}$, whichever is greater, where

V_{s_1} = stalling speed, flaps retracted at design landing weight

V_{s_0} = stalling speed, flaps in landing position, design landing weight

(See § 4b.193 for provision concerning automatic flap operation.)

V_p (design maneuvering speed) $=V_{s_1}\ \sqrt{n}$ where n = limit maneuvering load factor used in design (see § 4b.190)

V_{s_1} = stalling speed with flaps retracted at design take-off weight

V_b (design speed for 40 feet per second gust) the speed at which the effective 40 feet per second gust line intersects the positive $C_{N\max}$ curve on the gust V–n envelope (see § 4b.191 and Figure 4b–2).

V_c (design cruising speed) V_c shall not be less than V_b plus 50 except that it need not exceed the speeds at altitude corresponding to a Mach number of 0.52 or the high speed of the airplane in level flight at maximum continuous power for the corresponding altitude. However, in no case shall V_c be less than $1.3\ V_{s_1}$ with flaps retracted at design take-off weight.

V_d (design dive speed) V_d shall be 1.25 times the value selected for V_c or the selected V_c plus 70 miles per hour, whichever is greater; however V_d need not exceed the speed corresponding to a Mach number of 0.65. In any event, V_d need not exceed the terminal velocity in a dive at 30 degrees to the horizontal. At all speeds in excess of those corresponding to a Mach number of 0.65 compressibility effects shall be taken into account.

§ 4b.190 *Maneuvering envelope.* (a) The airplane shall be assumed to be subjected to symmetrical maneuvers resulting in the following limit load factors except where limited by maximum (static) lift coefficients:

(1) The positive maneuvering load factor, n, at all speeds up to V_d. The value of n shall be selected by the designer except that it shall not be less than 2.5.

(2) The negative maneuvering load factor shall have a minimum value of -1.0 at all speeds up to V_c; and factors varying linearly with speed from the specified value at V_c to 0.0 at V_d.

(b) Lower values of maneuvering load factor may be employed only if it be proven that the airplane embodies features of design which make it impossible to exceed such values in flight.

§ 4b.191 *Gust envelope.* The airplane shall be assumed to encounter symmetrical vertical gusts as specified below while in level flight. The resulting loads shall be considered limit loads.

(a) Positive (up) and negative (down) gusts of 40 feet per second nominal intensity at the speed, V_b, where the 40 feet per second gust line intersects the positive $C_{N\max}$ curve. If this gust intensity produces load factors greater than those obtained in condition (b) following, it may be modified at altitudes above 20,000 feet in such a manner as to produce a load factor not less than that obtained in condition (b).

(b) Positive and negative gusts of 30 feet per second at V_c.

(c) Positive and negative 15 feet per second gusts at V_d. Gust load factors shall be assumed to vary linearly between the specified conditions as shown on the gust envelope of Figure 4b–2.

§ 4b.192 *Gust load factors.* In applying the gust requirements, the gust load factors shall be computed by the following formula:

$$n=1+\frac{KUVa}{575\ (W/S)}$$

Where:

$$K=\frac{1}{2}\left(\frac{W}{S}\right)^{1/4}\ \text{(for } W/S<16 \text{ p. s. f.)}$$

$$=1.33-\frac{2.67}{(W/S)^{3/4}}\ \text{(for } W/S>16 \text{ p. s. f.)}$$

U = nominal gust velocity, feet per second.

(Note that the "effective sharp edged" gust equals KU)

V = airplane speed, miles per hour.

a = slope of airplane normal force coefficient curve, C_{NA} per radian, corrected for aspect ratio

W/S = wing loading, pounds per square foot

HIGH LIFT DEVICES EXTENDED CONDITIONS

§ 4b.193 *High lift devices extended.* When flaps or similar high lift devices intended for use at the relatively low air speeds of approach, landing, and take-off are installed, the airplane shall be assumed to be subjected to symmetrical maneuvers and gusts with the flaps in landing position at the design flap speed, V_f, resulting in limit load factors within the range determined by the following conditions:

(a) Maneuvering to a positive limit load factor of 2.0.

(b) Positive and negative 15 feet per second nominal intensity gusts acting normal to the flight path in level flight. The gust load factors shall be computed by the formula of § 4b.192. In designing the flaps and supporting structures, slipstream effects must be taken into account as specified in § 4b.221. When automatic flap operation is provided, the airplane may be designed for the speeds and corresponding flap positions which the mechanism permits. (See §§ 4b.2, 4b.354 and 4b.355.)

INVESTIGATION OF SPECIFIC CONDITIONS

§ 4b.196 *General.* (a) A sufficient number of points on the maneuvering and gust envelopes shall be investigated to insure that the maximum load for each member of the airplane structure has been obtained. A conservative combined envelope may be used for this purpose if desired. At least the conditions specified in §§ 4b.197–4b.198 shall be investigated unless shown to be noncritical.

(b) All significant forces acting on the airplane shall be placed in equilibrium in a rational or conservative manner. At least the following forces shall be considered in establishing such equilibrium:

(1) Linear inertia forces in equilibrium with wing and horizontal tail surface loads.

(2) Pitching (angular) inertia forces in equilibrium with wing and fuselage aerodynamic moments and horizontal tail surface loads.

(c) Terms used in §§ 4b.197 (b) and 4b.198 are defined as follows:

(1) A "balancing tail load" is that necessary to place the airplane in equilibrium with zero pitching acceleration.

(2) A "checked maneuver" is one in which the pitching control is suddenly displaced in one direction and then suddenly moved in the opposite direction, the deflections and timing being such as to avoid exceeding the limit maneuvering load factor.

(d) Where sudden displacement of a control is specified, the assumed rate of displacement need not exceed that which would actually be applied by the pilot.

§ 4b.197 *Maneuvering conditions*—(a) *Balanced conditions.* The maneuvering conditions A through I on the maneuvering envelope (Fig. 4b–1) shall be investigated assuming the airplane in equilibrium with zero pitching acceleration.

(b) *Pitching conditions.* The following conditions on Figure 4b–1 involving pitching acceleration shall be investigated.

(1) A_1. *Unchecked pull-up at speed,* V_p. The airplane shall be assumed to be flying in steady level flight and the pitching control suddenly moved to obtain extreme positive pitching, except as limited by pilot effort, § 4b.217.

(2) A_2, *Checked maneuver at speed,* V_p. The airplane shall be assumed to be maneuvered to the limit positive maneuvering load factor by a checked maneuver from an initial condition of steady unaccelerated flight. The initial positive pitching portion of this maneuver may be considered covered by subparagraph (1) of this paragraph.

A negative pitching acceleration of at least the following value shall be assumed to be attained concurrently with the airplane limit maneuvering load factor, unless it is shown that a lesser value could not be exceeded:

$$-\frac{30}{V_p}\ n\ (n-1.5)\ \text{(radians/sec.}^2\text{)}$$

(3) D_1 *and* D_2, *Checked maneuver at* V_d. The airplane shall be assumed to be maneuvered to the limit positive maneuvering load factor by a checked maneuver from steady unaccelerated flight.

Positive and negative pitching accelerations of at least the following values shall be assumed to be attained concurrently with the specified airplane load factors, unless it is shown that lesser values could not be exceeded:

Condition D_1: $+\frac{45}{V_d}n\ (n-1.5)$ (radians/sec²) with the airplane at unity load factor.

Condition D_2: $-\frac{30}{V_d}n\ (n-1.5)$ (radians/sec²) with the airplane at maneuvering load factor.

where n = limit maneuvering load factor in both equations.

§ 4b.198 *Gust conditions.* The gust conditions B′ through J′ on Figure 4b–2 shall be investigated. The air load increment due to a specified gust shall be added to the initial balancing tail load corresponding to steady unaccelerated flight. The alleviating effects of wing downwash may be included in computing the tail gust load increment.

UNSYMMETRICAL FLIGHT CONDITIONS

§ 4b.200 *Unsymmetrical flight conditions.* The airplane shall be assumed to be subjected to rolling and yawing maneuvers as described in the following conditions in §§ 4b.201 and 4b.202. Unbalanced aerodynamic moments about the center of gravity shall be reacted in a rational or conservative manner considering the principal masses furnishing the reacting inertia forces.

§ 4b.201 *Rolling conditions.* (a) The airplane shall be designed for the loads resulting from the following aileron deflections and speeds (except as limited by pilot effort as specified in § 4b.217) in combination with an airplane load factor of at least two-thirds of the positive maneuvering factor used in the design of the airplane.

(1) At speed, V_p, assume a sudden displacement of the aileron to the stop. A simplified condition of zero rolling velocity or the actual resulting dynamic condition may be used for design.

(2) When V_c is greater than V_p, the aileron deflection at V_c shall be that required to produce a rate of roll not less than that which would be obtained at the speed and aileron deflection specified in paragraph (a) of this section.

(3) At speed, V_d, the aileron deflection shall be that required to produce a rate of roll not less than ⅓ of that which would be obtained at the speed and aileron deflection specified in paragraph (a) of this section.

(b) To cover unsymmetrical gusts, the airplane shall be designed for loads obtained by modifying the symmetrical flight condition A shown on Figure 4b–1 by assuming 100% of the wing air load acting on one side of the airplane and 90% on the other.

§ 4b.202 *Yawing conditions.* The airplane shall be designed for the yawing loads resulting from the conditions in paragraphs (a) and (b) of this section.

(a) *Maneuvering loads.* At all speeds from V_{mc} to V_p the following vertical tail loads shall be considered:

(1) (i) With the airplane in unaccelerated flight at zero yaw, assume a sudden displacement of the rudder control to the maximum deflection as limited by the control stops or a 300 lb. rudder pedal force, whichever is critical.

(ii) In the conditions set forth in subparagraphs (2) and (3) of this paragraph it shall be assumed that the airplane yaws to a sideslip angle resulting from the application of the above rudder angle.

(2) Assume that the airplane yaws to the above sideslip angles while the rudder control is maintained at full deflection (except as limited by pilot effort) in the direction tending to increase the sideslip.

(3) Assume that the airplane yaws to the above sideslip angles with the rudder control in the neutral position, except as limited by the pilot effort.

(4) Yawing velocity may be assumed zero in conditions set forth in this paragraph.

(b) *Lateral gusts.* (1) The airplane shall be assumed to encounter gusts of 30 feet per second nominal intensity, normal to the plane of symmetry while in unaccelerated flight at speed, V_c.

(2) The gust loading on the vertical tail surfaces shall be computed by the following formula:

$$W=\frac{KUV_c a}{575}$$

Where:

W=average limit unit pressure in pounds per square foot.

$K=1.33-\dfrac{4.5}{\left(\dfrac{W}{S_v}\right)^{3/4}}$; except that K shall not be less than 1.0. A value of K obtained by rational determination may be used.

U=nominal gust intensity in feet per second.

V_c=design cruising speed in miles per hour.

a=slope of lift curve of vertical surface in radians corrected for aspect ratio.

S_v=vertical surface area, square feet.

W=design take-off weight, pounds.

[Amdt. 04–0, 11 F. R. 71, as amended by Amdt. 04b–5, 12 F. R. 3933]

SUPPLEMENTARY FLIGHT CONDITIONS

§ 4b.206 *Engine torque effects.* (a) Engine mounts and their supporting structures shall be designed for engine torque effects combined with certain basic flight conditions as described in subparagraphs (1) and (2) of this paragraph. Engine torque may be neglected in the other flight conditions.

(1) The limit torque corresponding to take-off power and propeller speed acting simultaneously with 75% of the limit loads from flight condition A (see Fig. 4b–1).

(2) The limit torque corresponding to maximum continuous power and propeller speed, acting simultaneously with the limit loads from flight condition A (see Fig. 4b–1).

(b) The limit torque shall be obtained by multiplying the mean torque by a factor of 1.33 in the case of engines having 5 or more cylinders. For 4-, 3-, and 2-cylinder engines, the factors shall be 2, 3, and 4, respectively.

§ 4b.207 *Side load on engine mount.* The limit load factor in a lateral direction for this condition shall be at least equal to the maximum obtained in the unsymmetrical flight (yawing) conditions but shall not be less than either ⅓ the limit load factor for flight condition A (see Fig. 4b–1) or 1.33. Engine mounts and their supporting structures shall be designed for this condition which may be assumed independent of other flight conditions.

§ 4b.208 *Pressure cabin loads.* See § 4b.451 (a).

CONTROL SURFACE LOADS

§ 4b.216 *General.* The control surfaces shall be designed for the limit loads resulting from the symmetrical and unsymmetrical flight condition as described in §§ 4b.196 and 4b.200 with the provisions set forth in §§ 4b.217–4b.223.

§ 4b.217 *Pilot effort.* In the control surface flight loading conditions, the airloads on the movable surfaces and the corresponding deflections need not exceed those which could be obtained in flight by employing the maximum pilot control forces specified in Figure 4b–3, except that two-thirds of the maximum values specified for the aileron and elevator may be used when reliable control surface hinge moment data are available. In applying this criterion, proper consideration shall be given to the effects of servo mechanisms, tabs, and automatic pilot systems in assisting the pilot.

§ 4b.218 *Trim tab effects.* The effects of trim tabs on the control surface design conditions need be taken into account only in cases where the surface loads are limited on the basis of maximum pilot effort in accordance with the provision of § 4b.217. In such cases the tabs shall be considered to be deflected in the direction which would assist the pilot and the deflections shall be those specified in § 4b.222.

§ 4b.219 *Unsymmetrical loads.* The maximum horizontal tail surface loading (that is, load per unit area) as determined by §§ 4b.216–4b.218 shall be applied to the horizontal surfaces on one side of the plane of symmetry and 80% of that loading shall be applied to the opposite side.

§ 4b.220 *Outboard fins.* When outboard fins are carried on the horizontal tail surface, the tail surfaces shall be designed for the maximum horizontal surface load in combination with the corresponding loads induced on the vertical surfaces by end plate effects. Such induced effects need not be combined with other vertical surface loads. When outboard fins extend above and below the horizontal surface, the maximum vertical surface loading (load per unit area) as determined by § 4b.216 shall be applied to the portion of the vertical surfaces above (or below) the horizontal surface, and 80% below (or above) the horizontal surface.

§ 4b.221 *Wing flaps.* Wing flaps, their operating mechanism and supporting structure shall be designed for critical loads occurring in the high lift devices extended conditions (§ 4b.193) with the flaps extended to any position from fully retracted to landing position. The effects of propeller slipstream corresponding to take-off power shall be taken into account at an airplane speed of not less than 1.4 V_{s_1} where V_{s_1} is the stalling speed with flaps retracted at the appropriate weight, that is, landing weight for landing, and approach settings, and take-off for take-off setting. (For automatic flaps, see § 4b.193.)

§ 4b.222 *Tabs.* At all speeds up to V_d, elevator trim tabs shall be designed for the deflections required to trim the airplane at any point within the positive portion of the *V–n* diagram (Fig. 4b–1), except as limited by the stops. Aileron and rudder trim tabs shall be designed for deflections required to trim the airplane in appropriate unsymmetrical lateral loading and rigging, and symmetrical and unsymmetrical power conditions. Balancing and servo tabs shall be designed for deflections consistent with the primary control surface loading conditions.

§ 4b.223 *Special devices.* The loading for special devices employing aerodynamic surfaces, such as slots and spoilers, shall be based on test data.

CONTROL SYSTEM LOADS

§ 4b.231 *Primary flight controls and systems.* (a) Flight control systems and supporting structures shall be designed for loads corresponding to 125% of the computed hinge moments of the movable control surface in the conditions prescribed in §§ 4b.216–4b.223, subject to the following maxima and minima:

(1) The system limit loads, except the loads resulting from ground gusts, § 4b.233, need not exceed those which can be produced by the pilot or pilots and automatic devices operating the controls.

(2) The loads shall in any case be sufficient to provide a rugged system for service use, including considerations of jamming, ground gusts, taxying tail to wind control inertia, and friction.

(b) Acceptable maximum and minimum pilot loads for elevator, aileron, and rudder controls are shown in Figure 4b–3. These pilot loads shall be assumed to act at the appropriate control grips or pads in a manner simulating flight conditions and to be reacted at the attachment of the control system to the control surface horn.

§ 4b.232 *Dual controls.* (a) When dual controls are provided, the system shall be designed for the pilots operating in opposition, using individual pilot loads equal to 75% of those obtained in accordance with § 4b.231 except that the individual pilot loads shall not be less than the minimum loads specified in Figure 4b–3.

(b) In addition the control system (but not the control surfaces) shall be designed for the pilots acting in conjunction, using individual pilot loads equal to 75% of those obtained in accordance with § 4b.231.

§ 4b.233 *Ground gust conditions.* (a) The following ground gust conditions, intended to simulate the loadings on control surfaces due to ground gusts and taxying tail to wind, shall be investigated. The limit hinge moment, H, shall be obtained from the following formula:

$H = KcSq,$

where

H = limit hinge moment (foot-pounds)

c = Mean chord (aft) of the control surface aft of the hinge line

S = area of control surface (square feet) aft of the hinge line

q = dynamic pressure (pounds per square foot) to be based on a design speed not less than $10\sqrt{W/S}+10$, miles per hour, except that the design speed need not exceed 60 miles per hour

K = Factor as specified below:

Surface	K	Remarks
Aileron	+0.75	Control column locked or lashed in mid-position.
	±0.50	Ailerons at full throw + moment on one aileron − moment on other.
Elevator	±0.75	Elevator (a) full up, and (b) full down.
Rudder	±0.75	Rudder (a) in neutral and (b) at full throw.

(b) As used above in connection with ailerons and elevators, a positive value of K indicates a moment tending to depress the surface while a negative value of K indicates a moment tending to raise the surface.

LIMIT PILOT LOADS

Control	Maximum load	Minimum load
Aileron:		
Stick	100 lbs.	40 lbs.
Wheel [1]	80 D in./lbs. [2]	40 D in./lbs.
Elevator:		
Stick	250 lbs.	100 lbs.
Wheel	300 lbs.	100 lbs.
Rudder	300 lbs.	130 lbs.

[1] The critical portions of the aileron control system shall also be designed for a single tangential force having a limit value equal to 1.25 times the couple force determined from the above criteria.

[2] D = wheel diameter.

FIGURE 4b–3. PILOT CONTROL FORCE LIMITS.

§ 4b.234 *Secondary controls and systems.* Secondary controls, such as wheel brakes, spoilers, and tab controls shall be designed for the loads based on the maximum which a pilot is likely to apply to the control in question. The values of Figure 4b–4 may be used.

SECONDARY CONTROLS

Control	Limit pilot loads
Miscellaneous: [1] Crank wheel or lever.	$\frac{1+R}{3} \times 50$ lb., but not less than 50 lb. nor more than 150 lb. (R = radius). Applicable to any angle within 20 degrees of plane of control.
Twist	133 in./lbs.
Push-pull	No requirement—leave to discretion of designer.

[1] Limited to flap, tab, stabilizer, spoiler, and landing gear operating controls.

FIGURE 4b–4. PILOT CONTROL FORCE LIMITS.

GROUND LOADS

§ 4b.241 *Limit loads.* The limit loads specified in §§ 4b.242–4b.255 shall be considered as the minimum acceptable structural requirements for landing and ground handling conditions. These limit loads shall be considered as external forces applied to the airplane structure and shall be placed in equilibrium by linear and angular inertia forces in a rational or conservative manner.

§ 4b.242 *Design weights.* The critical center of gravity position within the limits for which certification is desired shall be selected so that the maximum design loads in each of the landing gear elements are obtained for both the design landing weight and the design take-off weight, as defined in § 4b.54.

§ 4b.243 *Load factor for landing conditions.* (a) In the following landing conditions the limit vertical inertia load factor at the center of gravity of the airplane shall be chosen by the designer, but shall not be less than the value which would be obtained when landing the airplane with a descent velocity as follows:

(1) Landing at the design landing weight with a limit descent velocity of 10 feet per second.

(2) Landing at the design take-off weight with a limit descent velocity of 6 feet per second.

(b) Wing lift not exceeding ⅔ of the airplane weight may be assumed to exist throughout the landing impact and may, if desired, be assumed to act through the airplane center of gravity. The ground reaction load factor is then equal to the inertia load factor minus the ratio of the assumed wing lift to the airplane weight. (See § 4b.372 for requirements concerning the energy absorption tests which determine the minimum limit inertia load factors corresponding to the required limit descent velocities.)

(c) The requirements of paragraph (a) and (b) of this section are predicated on conventional arrangements of main and nose gears, or main and tail gears, and normal operating techniques. These velocities may be appropriately modified if it can be shown that the airplane embodies features of design which make it impossible to develop these velocities, in which case lower values may be used subject to the approval of the Administrator.

§ 4b.244 *Landing cases and attitudes.* The airplane shall be assumed to contact the ground with the specified vertical velocities in the attitudes described in §§ 4b.245–4b.248.

§ 4b.245 *Level landing*—(a) *General.* In the level attitude, the airplane shall be assumed to contact the ground with the rates of descent specified in § 4b.243 at a forward velocity component parallel to the ground equal to 1.2 V_{s_1}. The following two combinations of vertical and drag components shall be considered acting at the axle center line:

(1) *Condition of maximum wheel spin-up load.* Drag components simulating the forces required to accelerate the wheel rolling assembly up to the specified ground speed shall be combined with the vertical ground reactions existing at the instant of peak drag loads. This condition may be considered to apply only to the landing gear and the directly affected attaching structure.

(2) *Condition of maximum wheel vertical load.* An aft acting drag component not less than 25% of the maximum vertical ground reaction shall be combined with the maximum ground reaction of § 4b.243.

(b) *Tail wheel type.* The airplane horizontal reference line shall be assumed horizontal. Two conditions shall be investigated (see Fig. 4b–5):

(1) Condition of maximum wheel spin-up load.

(2) Condition of maximum wheel vertical load.

(c) *Nose wheel type.* Two airplane attitudes shall be considered (see Fig. 4b–6):

(1) Main wheels contacting the ground with the nose wheel just clear of the ground. Two conditions shall be investigated:

(i) Condition of maximum wheel spin-up load.

(ii) Condition of maximum wheel vertical load.

(2) Nose and main wheels contacting the ground simultaneously. (Unless such an attitude cannot reasonably be attained at the specified descent and forward velocities.) Two conditions shall be investigated:

(i) Condition of maximum wheel spin-up load. The nose and main gear may be investigated separately for this condition neglecting pitching moments due to wheel spin-up loads.

(ii) Condition of maximum wheel vertical load. The pitching moment shall be assumed to be resisted by the nose gear.

§ 4b.246 *Tail-down landing.* The following conditions shall be investigated for the limit vertical landing gear load factor obtained in § 4b.243 with the vertical ground reactions applied to the landing gear axles.

(a) *Tail wheel type.* The main and tail wheels shall be assumed contacting the ground simultaneously. (See Fig. 4b–7.) The ground reaction on the tail wheel, as determined from the above, shall be assumed to act in the following directions: (1) Vertical, (2) up and aft through the axle at 45° to the ground line.

(b) *Nose wheel type.* The airplane shall be at the stalling attitude or the maximum angle permitting clearance of the ground by all parts of the airplane, whichever is the lesser. (See Figure 4b–8.)

§ 4b.247 *One-wheel landing.* The main landing gear on one side of the airplane center line shall contact the ground in the level attitude. (See Figure 4b–9.) The ground reaction on this side may be taken the same as those obtained in § 4b.245. The unbalanced external loads shall be rationally or conservatively reacted by inertia of the airplane.

§ 4b.248 *Lateral drift landing.* The airplane shall be in the level attitude with only the main wheels contacting the ground. (See Fig. 4b–10.) Side loads of 0.8 of the vertical reaction (on one side) acting inward and 0.6 of the vertical reaction (on the other side) acting outward shall be combined with ½ of the maximum vertical ground reactions obtained in the level landing conditions. (§ 4b.245.) These loads are applied at the ground contact point and may be assumed resisted by the inertia of the airplane. Drag loads may be assumed zero.

TAXYING CONDITIONS

§ 4b.251 *General.* The landing gear and airplane structure shall be investigated for the conditions stated in §§ 4b.-252 to 4b.255, in which the airplane shall be assumed at the design take-off weight unless otherwise specified. No wing lift shall be considered.

[Amdt. 04b–5, 12 F. R. 3933]

§ 4b.252 *Take-off run.* The landing gear and airplane structure shall be designed for loads not less than those resulting from the condition specified in § 4b.164.

§ 4b.253 *Braked roll*—(a) *Tail wheel type:* The airplane shall be assumed in the level attitude with all load on the main wheels. The limit vertical load factor shall be 1.2 for the airplane at design landing weight and 1.0 for the airplane at design take-off weight. A drag reaction equal to the vertical reaction multiplied by a coefficient of friction of 0.8 shall be applied at the ground contact point in combination with the vertical ground reaction. (See Figure 4b–11.)

(b) *Nose wheel type.* The limit vertical load factor shall be 1.2 for the airplane at design landing weight and 1.0 for the airplane at design take-off weight. A drag reaction equal to 0.8 of the vertical reaction shall be combined with the vertical reaction and applied at the ground contact point of each wheel having brakes. Two airplane attitudes shall be considered. (See Figure 4b–13.)

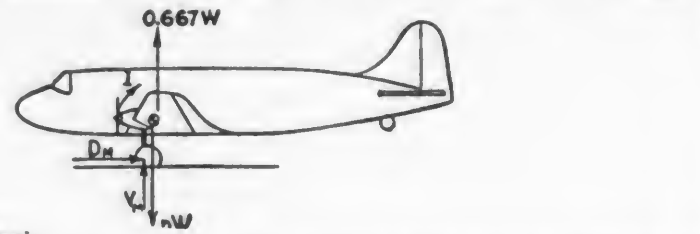
(1) The airplane in the level attitude with all wheels contacting the ground, assuming zero pitching acceleration and the loads distributed between the main and nose gear by the principles of statics.

(2) The airplane in the level attitude with only the main gear contacting the ground and the pitching moment resisted by angular acceleration.

[Amdt. 04–0, 11 F. R. 71, as amended by Amdt. 04b–5, 12 F. R. 3933]

§ 4b.254 *Ground maneuvering*—(a) *Turning.* The airplane in the static position shall be assumed to execute a steady turn by nose gear steering or differential power such that the limit load factors applied at the center of gravity are 1.0 vertically and 0.5 laterally. The side ground reaction at each wheel shall be 0.5 of the vertical reaction. (See Figures 4b–12 and 4b–14.)

(b) *Pivoting.* The airplane shall be assumed to pivot about one main gear, the brakes on that gear being locked. The limit vertical load factor shall be 1.0 and the coefficient of friction 0.8. The airplane shall be assumed to be in static equilibrium, the loads being applied at the ground contact points. (See Figure 4b–15.)



Two conditions are used:

(1) $D_m = \mu V_m$ where V_m is vertical wheel reaction at instant wheels are up to speed and μ is coefficient of friction. μ may be assumed equal to 0.8. $12W$ = value necessary for balance.

(2) $D_m = 0.25\ V_m$ where $_nW$ is determined by energy absorption requirements for landing.

FIGURE 4b–5.—LEVEL LANDING—TAIL WHEEL TYPE.

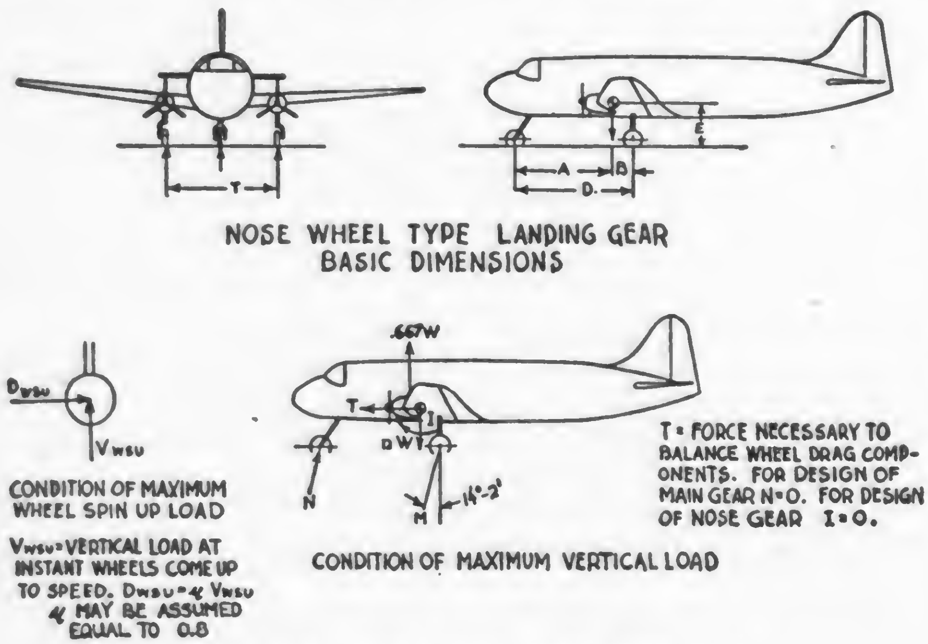


FIGURE 4b–6.—LEVEL LANDING—NOSE WHEEL TYPE.

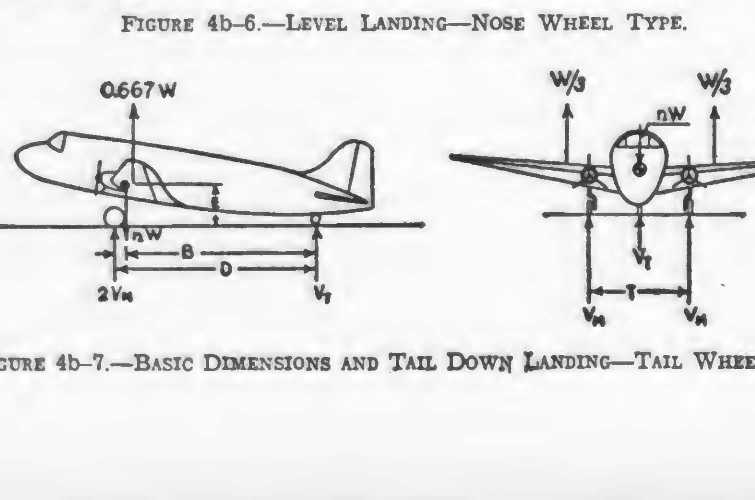
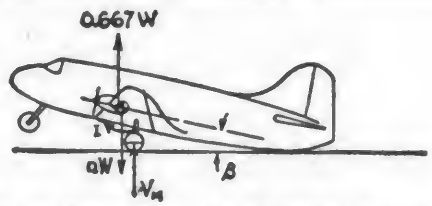


FIGURE 4b–7.—BASIC DIMENSIONS AND TAIL DOWN LANDING—TAIL WHEEL TYPE.

(c) *Nose wheel yawing.* (1) A vertical load factor of 1.0 at the airplane center of gravity and a side component at the nose wheel ground contact equal to 0.8 of the vertical ground reaction at that point shall be assumed.

(2) The airplane shall be placed in static equilibrium with the loads resulting from the application of the brakes on one main gear. The vertical load factor at the center of gravity shall be 1.0. The forward acting load at the airplane center of gravity shall be 0.8 V_m where V_m is the vertical load on one main gear. The side and vertical loads at the ground contact point on the nose gear are those required for static equilibrium. The side load factor at the airplane center of gravity shall be assumed zero.

(d) *Tail wheel yawing.* A vertical ground reaction equal to the static load on the tail wheel, in combination with a side component of equal magnitude shall be assumed. When a swivel is provided, the tail wheel shall be assumed swiveled 90° to the airplane longitudinal axis with the resultant load passing through the axle. When a lock, steering device, or shimmy damper is provided, the tail wheel shall also be as-



β—Angle for main gear and tail structure contacting ground except need not exceed stall angle.

FIGURE 4b-8.—TAIL DOWN LANDING—NOSE WHEEL TYPE.

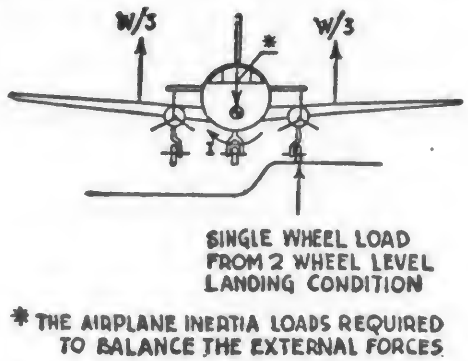


FIGURE 4b-9.—ONE WHEEL LANDING—NOSE OR TAIL WHEEL TYPE.

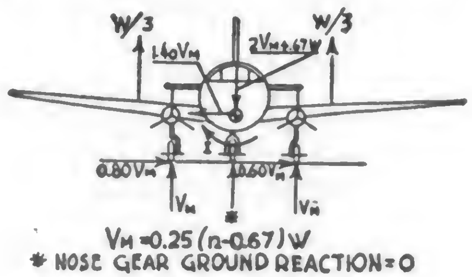


FIGURE 4b-10.—LATERAL DRIFT LANDING—NOSE OR TAIL WHEEL TYPE—AIRPLANE IN LEVEL ATTITUDE.

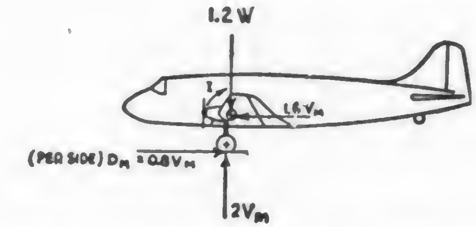


FIGURE 4b-11.—BRAKED ROLL TAIL WHEEL TYPE.

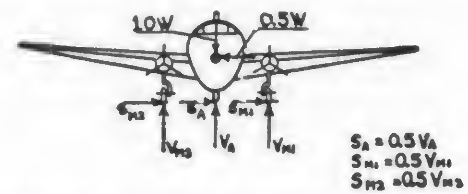


FIGURE 4b-12.—GROUND TURNING TAIL WHEEL TYPE.

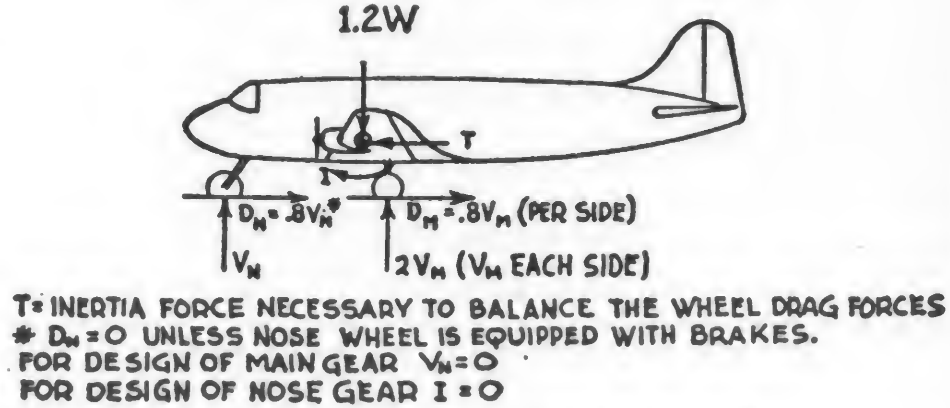


FIGURE 4b-13.—BRAKED ROLL—NOSE WHEEL TYPE.

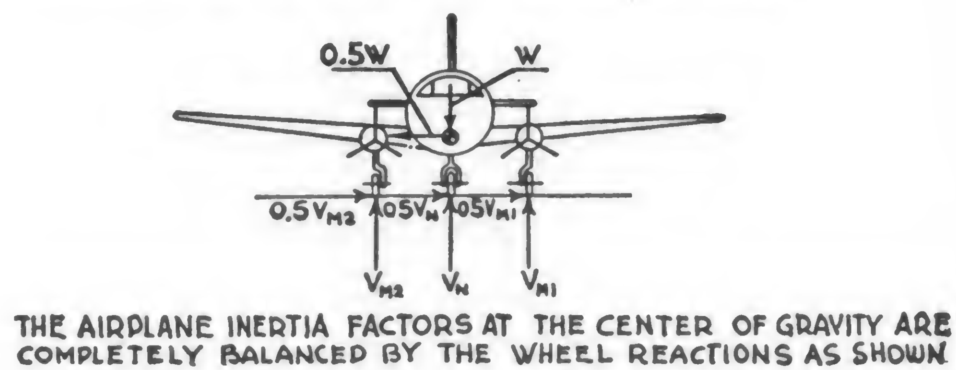
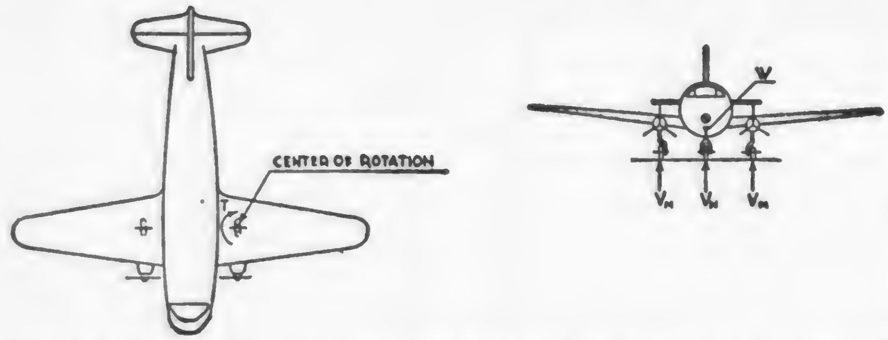


FIGURE 4b-14.—GROUND TURNING—NOSE WHEEL TYPE.



V_N and V_m are static ground reactions for tail wheel type; the airplane is in the three point attitude with static landing gear reactions, pivoting about one main landing gear unit.

FIGURE 4b-15.—PIVOTING NOSE OR TAIL WHEEL TYPE.

sumed in the trailing position with the side load acting at the ground contact point.

§ 4b.255 *Unsymmetrical loads on dual wheel units.* In dual wheel units, 60% of the total ground reaction for the unit shall be applied to one wheel and 40% to the other. To provide for the case of one tire flat, either wheel shall be capable of withstanding 60% of the load which would be assigned to the unit in the specified conditions, except that the vertical ground reaction shall not be less than full static value.

WATER LOADS

§ 4b.261 *General.* The requirements set forth in §§ 4b.262–4b.288 shall apply to the entire airplane, but have particul.. reference to hull structure, wing, nacelles, and float supporting structure.

§ 4b.262 *Design weight.* The design weight used in the water landing conditions shall be not less than the design landing weight, except that local bottom pressure conditions shall be investigated at the design take-off weight.

BOAT SEAPLANES

§ 4b.266 *Local bottom pressures*—(a) *Maximum local pressure.* The maximum value of the limit local pressure shall be determined from the following equation:

$$p_{max}=0.04\ V_s^{1.8}$$

Where:

p=pressure, pounds per square inch

V_s=stalling speed with flaps fully retracted at design take-off weight

(b) *Variation in local pressure.* The local pressures to be applied to the hull bottom shall vary in accordance with Figure 4b–16. No variation from keel to chine (beamwise) shall be assumed, except when the chine flare indicates the advisability of higher pressures at the chine.

(c) *Application of local pressure.* The local pressures determined in paragraphs (a) and (b) of this section shall be applied over a local area in such a manner as to cause the maximum local loads in the hull bottom structure.

§ 4b.267 *Distributed bottom pressures.* (a) For the purpose of designing frames, keels, and chine structure, the limit pressures obtained from § 4b.266, using a value of W not less than design landing weight, and Figure 4b–16 shall be reduced to ½ the local values and simultaneously applied over the entire hull bottom. The loads so obtained shall be carried into the side-wall structure of the hull proper, but need not be transmitted in a fore-and-aft direction as shear and bending loads.

(b) *Unsymmetrical loading.* Each floor member or frame shall be designed for a load on one side of the hull center line equal to the most critical symmetrical loading, combined with a load on the other side of the hull center line equal to ½ of the most critical symmetrical loading.

§ 4b.268 *Step loading condition*—(a) *Application of load.* The resultant water load shall be applied vertically in the plane of symmetry so as to pass through the center of gravity of the airplane.

(b) *Acceleration.* The limit acceleration shall be 4.0, unless a lower value is substantiated by suitable tests such as impact basin tests.

(c) *Hull shear and bending loads.* The hull shear and bending loads shall be computed from the inertia loads produced by the vertical water load. To avoid excessive local shear loads and bending moments near the point of water load application, the water load may be distributed over the hull bottom, using pressures not less than those specified in § 4b.267.

§ 4b.269 *Bow loading condition*—(a) *Application of load.* The resultant water load shall be applied in the plane of symmetry at a point $\frac{1}{10}$ of the distance from the bow to the step and shall be directed upward and rearward at an angle of 30° from the vertical.

(b) *Magnitude of load.* The magnitude of the limit resultant water load shall be determined from the following equation:

$$p_b=\tfrac{1}{2}n_sW_s$$

where:

p_b=the load in pounds.

n_s=the step landing load factor.

W_s=an effective weight which is assumed equal to ½ the design landing weight of the airplane.

(c) *Hull shear and bending loads.* The hull shear and bending loads shall be determined by proper consideration of the inertia loads which resist the linear and angular accelerations involved. To avoid excessive local shear loads, the water reaction may be distributed over the hull bottom, using pressures not less than those specified in § 4b.267.

§ 4b.270 *Stern loading condition*—(a) *Application of load.* The resultant water load shall be applied vertically in the plane of symmetry and shall be distributed over the hull bottom from the second step forward with an intensity equal to the pressures specified in § 4b.267.

(b) *Magnitude of load.* The limit resultant load shall equal ¾ of the design landing weight of the airplane.

(c) *Hull shear and bending loads.* The hull shear and bending loads shall be determined by assuming the hull structure to be supported at the wing attachment fittings and neglecting internal inertia loads. This condition need not be applied to the fittings or to the portion of the hull ahead of the rear attachment fittings.

§ 4b.271 *Side loading condition*—(a) *Application of load.* The resultant water load shall be applied in a vertical plane through the center of gravity. The vertical component shall be assumed to act in the plane of symmetry and horizontal component at a point half way between the bottom of the keel and the load waterline at design landing weight (at rest).

(b) *Magnitude of load.* The limit vertical component of acceleration shall be 3.25 and the side component shall be equal to 15% of the vertical component.

(c) *Hull shear and bending loads.* The hull shear and bending loads shall be determined by proper consideration of the inertia loads or by introducing cou-

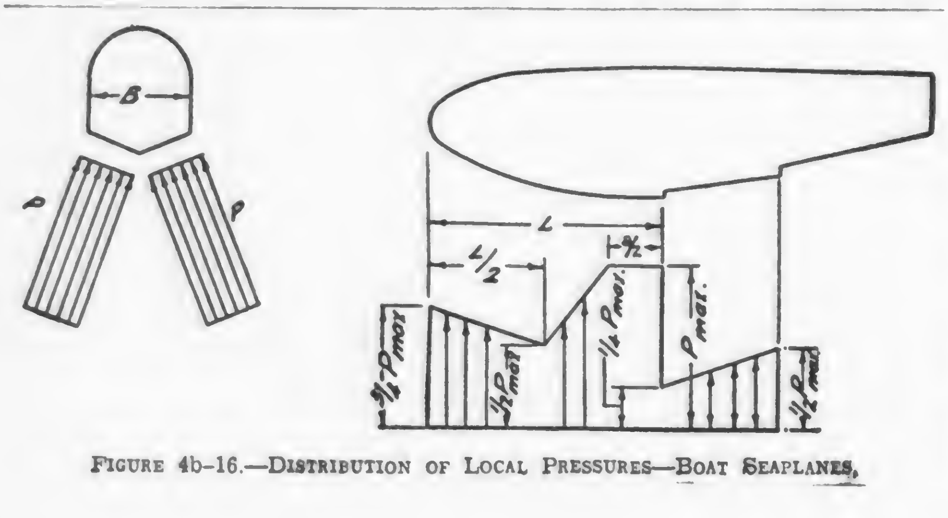


FIGURE 4b–16.—DISTRIBUTION OF LOCAL PRESSURES—BOAT SEAPLANES.

ples at the wing attachment points. To avoid excessive local shear loads, the water reaction may be distributed over the hull bottom, using pressures not less than those specified by § 4b.267.

FLOAT SEAPLANES

§ 4b.276 *Landing with inclined reactions.* The vertical component of the limit load factor shall be 4.0, unless a lower value is substantiated by suitable tests such as impact basin tests. The propeller axis (or equivalent reference line) shall be assumed to be horizontal and the resultant water reaction to be acting in the plane of symmetry and passing through the center of gravity of the airplane, but inclined so that its horizontal component is equal to ¼ of its vertical component. Inertia forces shall be assumed to act in a direction parallel to the water reaction.

§ 4b.277 *Landing with vertical reactions (float seaplanes).* The limit load factor shall be 4.0 acting vertically, unless a lower value is substantiated by suitable tests, such as impact basin tests. The propeller axis (or equivalent reference line) shall be assumed to be horizontal, and the resultant water reaction to be vertical and passing through the center of gravity of the airplane.

§ 4b.278 *Landing with side load (float seaplanes).* The vertical component of the limit load factor shall be 4.0. The propeller axis (or equivalent reference line) shall be assumed to be horizontal and the resultant water reaction shall be assumed to be in the vertical plane which passes through the center of gravity of the airplane and is perpendicular to the propeller axis. The vertical load shall be applied through the keel or keels of the float or floats and evenly divided between the floats when twin floats are used. A side load equal to one-fourth of the vertical load shall be applied along a line approximately halfway between the bottom of the keel and the level of the water line at rest. When twin floats are used, the entire side load specified shall be applied to the float on the side from which the water reaction originates.

§ 4b.279 *Seaplane float loads.* Each main float of a float seaplane shall be capable of carrying the following loads when supported at the attachment fittings as installed on the airplane.

(a) A limit load, acting upward, applied at the bow end of the float and of magnitude equal to that portion of the airplane weight normally supported by the particular float.

(b) A limit load acting upward at the stern of magnitude equal to 0.8 times that portion of the airplane weight normally supported by the particular float.

(c) A limit load, acting upward, applied at the step and of magnitude equal to 1.5 times that portion of the airplane weight normally supported by the particular float.

§ 4b.280 *Seaplane float bottom loads.* Main seaplane float bottoms shall be designed to withstand the following loads:

(a) A limit bottom pressure of at least the value specified in § 4b.266, applied over that portion of the bottom lying between the first step and a section at 25% of the distance from the step to the bow.

(b) A limit bottom pressure of at least one-half the value specified in paragraph (a) of this section applied over that portion of the bottom lying between the section at 25% of the distance from the step to the bow and a section at 75% of the distance from the step to the bow.

(c) A limit bottom pressure of at least 0.3 of the values specified in paragraph (a) of this section, applied over that portion of the bottom aft of the step (aft of main step if more than one step is used).

WING-TIP FLOAT AND SEA WING LOADS

§ 4b.286 *Wing-tip float loads.* Wing-tip floats and their attachment, including the wing structure, shall be analyzed for each of the following conditions:

(a) A limit load acting vertically up at the completely submerged center of buoyancy and equal to three times the completely submerged displacement.

(b) A limit load inclined upward at 45° to the rear and acting through the completely submerged center of buoyancy and equal to three times the completely submerged displacement.

(c) A limit load acting parallel to the water surface (laterally) applied at the center of area of the side view and equal to 1.5 times the completely submerged displacement.

§ 4b.287 *Primary wing structure.* The primary wing structure shall incorporate sufficient extra strength to insure that failure of wing-tip float attachment members occurs before the wing structure is damaged.

§ 4b.288 *Sea wing loads.* Sea wing design loads shall be based on suitable test data.

EMERGENCY LANDING CONDITIONS

§ 4b.291 *General.* The following requirements deal with emergency conditions of landing on land or water in which the safety of the occupants shall be considered, although it is accepted that parts of the airplane may be damaged.

(a) The structure shall be designed to give every reasonable probability that all the occupants, if they make proper use of the seats, belts, and other provisions made in the design (see §§ 4b.441–4b.456) will escape serious injury in the event of a minor crash landing (with wheels up if the airplane is equipped with retractable landing gear) in which the occupants experience the following ultimate inertia forces relative to the surrounding structure.

Forward	0 to 6.0 g
Sideward	0 to 1.5 g
Vertical	0 to 4.5 g (down)
	0 to 2.0 g (up)

(b) A lesser value of the downward inertia force may be used if it is shown that the airplane structure could absorb the landing shock corresponding to the design landing weight and an ultimate descent velocity of 5 feet per second without exceeding the value chosen. The specified inertia forces shall also be applied to all items of mass which would be liable to injure the passengers or crew if they came adrift under such conditions, and the supporting structure shall be designed to restrain these items.

[Amdt. 04-0, 11 F. R. 71, as amended by Amdt. 04b-5, 12 F. R. 3933]

§ 4b.292 *Ditching provisions.* (a) At the request of the applicant, type certification may include certification that adequate provision has been made for emergency landings during overwater flights. In order that landplanes may qualify for such a certification, satisfactory evidence must be submitted that all practicable measures compatible with the general characteristics of the type have been taken to minimize the chance of any behavior of the airplane, in an emergency landing on water, which would be likely to cause immediate injury to the occupants or to make it impossible for them to escape from the airplane. (Airplanes that are to receive this special certification must also comply with the terms of § 4b.431).

(b) In demonstrating compliance with this requirement, the probable behavior of the airplane in a water landing shall be investigated by model tests or comparison with airplanes of similar configuration for which the ditching characteristics are known. In making such tests or comparisons proper consideration shall be given to scoops, flaps, projections, and all other factors likely to affect the hydrodynamic characteristics of the actual airplane. External doors and windows shall be designed to withstand the probable maximum local pressures unless the effects of the collapse of such parts are taken into account in the model tests or airplane comparison.

SUBPART D—DESIGN AND CONSTRUCTION

GENERAL

§ 4b.301 *Minimum tests.* The airplane shall not incorporate design features or details which experience has shown to be hazardous or unreliable. The suitability of all questionable design details or parts shall be established by tests. Minimum tests required to prove the strength and proper functioning of particular parts are specified.

§ 4b.302 *Materials.* The suitability and durability of all materials used in the airplane structure shall be established on the basis of experience or tests. All materials used in the airplane structure shall conform to approved specifications which will insure their having the strength and other properties assumed in the design data.

§ 4b.302-1 *Technical Standard Order TSO-C14: "Aircraft Fabric, 'Intermediate' Grade, External Covering Material" (CAA rules which apply to § 4b.302)*—(a) *Introduction.* (1) Aircraft fabric is in the class of aircraft components which the Administrator of Civil Aeronautics is authorized to approve in accordance with Parts 3, 4a and 4b of this subchapter.

(2) This Technical Standard Order is intended to serve as a criterion by which the product manufacturer can obtain Civil Aeronautics Administration approval of his aircraft fabric.

(3) In the establishment of this Technical Standard Order, consideration has been given to existing Government and industry standards for aircraft fabric for

the purpose of adopting the performance requirements of one of the recognized aeronautical standards as the minimum safety requirements for "intermediate" grade fabric which is intended for use as external covering material on civil aircraft or components thereof. The specifications of the Society of Automotive Engineers for "intermediate" grade fabric contains such requirements.

(b) *Directive.*

(1) *Provision.* Pursuant to §§ 3.31, 3.320, 4a.31, 4a.252, 4a.338, 4b.41, 4b.302, and 4b.332 of this subchapter, which authorize the Administrator to approve aircraft material, the performance requirements for "intermediate" grade fabric as set forth in section 5 of SAE Specification AMS 3804, Cloth; Airplane, Cotton, Mercerized, dated January 1, 1946,[1] stated below, are hereby established as the minimum safety requirements for "intermediate" grade fabric which is intended for external use on civil aircraft:

1. *Acknowledgment.* A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.

2. *Application.* The cloth shall be suitable for covering aircraft surfaces such as wings, fuselage, ailerons, and elevators.

3. *Material.* The cloth shall be woven from 1- or 2-ply, combed cotton yarn.

4. *Quality.* (a) The cotton fibers shall be evenly spun into yarns of proper and uniform yarn count, twist, and diameter to produce the texture and weight required.

(b) The yarn shall be reasonably free from nap breaks, broken ends, uneven threads and knots.

(c) Yarns shall be closely woven into fabric uniform in body and appearance, and which shall be reasonably free from striations due to variable weaving operations. Cloth shall be uniformly finished in accordance with the best practice for high-grade airplane cloth.

5. *Requirements.* (a) The cloth shall be piece mercerized, or the yarn may be mercerized under tension.

(b) The weave shall be plain (one up and one down).

(c) The number of threads shall be not more than 94 and not less than 80 per inch in either the warp or the fill.

(d) The selvage edges shall be flat woven with no greater tension than that of the body of the cloth.

(e) The breaking strength shall be not less than 65 pounds per inch of width in either the warp or fill as determined by the ravelled-strip method.

(f) The elongation shall be not greater than 13% in the warp and not greater than 11% in the fill when 57 pounds tension is applied during the ravelled-strip test.

(g) The tearing strength shall be not less than 4 pounds in either the warp or fill as determined by the trapezoid method.

(h) The weight of the finished cloth shall not exceed 4 ounces per square yard.

(i) The cloth shall contain not more than 2.5% total sizing, finishing and other non-fibrous materials and should be chemically neutral. A desizing operation may be performed if necessary to reduce the sizing content to the 2.5% maximum value specified.

(j) Finishing shall consist of washing, framing and calendering. The calendering shall be sufficient to lay any nap present and shall provide a smooth, even surface. Nap may be removed by singeing.

6. *Tests.* All tests shall be made in accordance with ASTM D39-39 except as follows: The test for total sizing, finishing and other non-fibrous materials shall be made in accordance with ASTM D629-42T, using equation 3 for calculation.

7. *Tolerances.* Unless otherwise specified on the drawing or purchase order, the following tolerances apply:

Width (inches):	*Tolerance (inches)*
36	±½
42	±⅝
60	±1
69	±1
90	±1½

8. *Length of cut.* The length of a single cut shall be not less than 40 yards except that 10% of the total yardage of one width under any contract or order may be in short lengths of from 10 to 25 yards and 10% may be from 25 to 40 yards. However, short lengths shall be rolled together and the roll properly labeled to indicate that it is composed of short lengths.

9. *Length of rolls.* The cloth shall be furnished on rolls containing the following lengths:

Width (inches):	*Roll length (yards)*
36 and 42	500 to 600
60 and 69	250 to 300
90	175 to 200

10. *Reports.* Unless otherwise specified, the vendor shall furnish for each shipment three copies of a notarized report stating that the cloth conforms to this specification. This report shall include the purchase order number, material specification number and quantity.

11. *Identification.* The cloth shall incorporate a continuous marking to show the manufacturer's name or trade mark and AMS 3804. This marking may be stamped along the selvage.

12. *Packaging.* (a) Packaging shall be accomplished in such a manner as to insure that the cloth, during shipment or storage, will be protected against exposure to moisture or weathering, or harmful agents of any kind.

(b) Each package shall be permanently and legibly marked to give the following information:

Cloth: airplane, cotton, mercerized 65 lbs. Breaking Strength AMS 3804
Yardage__________
Width__________
Date of manufacture__________
Order number__________
Manufacturer's name__________

13. *Approval.* A vendor shall not supply cloth to this specification until samples are approved by the purchaser and, after approval, the materials and/or methods of manufacture shall not be changed without written permission from the purchaser. Results of tests on incoming shipments shall be essentially equal to those on the approved samples.

14. *Rejections.* Cloth not conforming to this specification or to authorized modifications shall be subject to rejection. Unless otherwise stipulated, rejected cloth will be returned to vendor at vendor's expense, unless purchaser receives, within three weeks of notification of rejection, other instructions for disposition.

NOTE: *Similar specification.* ANC-121 is listed for information only and shall not be construed as an acceptable alternate unless all requirements of this AMS are met.

(2) *Application.* Fabric complying with the specifications appearing in this order is approved for all aircraft with wing loadings of less than 9 pounds per square foot and placard never-exceed speeds of less than 160 miles per hour. Fabric already approved by the Administrator may continue to be installed on aircraft:

(i) For which an application for original type certificate is made prior to the effective date of this order.

(ii) The prototype of which is flown within 1 year after the effective date of this order, and

(iii) The prototype of which is not flown within 1 year after the effective date of this order if due to causes beyond the applicant's control.

(c) *Specific instructions.*

(1) *Marking.* In addition to the identification information required in the referenced specification, the Technical Standard Order designation "CAA-TSO-C14" shall be marked continuously along the selvage edge of the cloth, except that for the purposes of this order, inclusion of the AMS number 3804 is not required. This will identify the fabric as meeting the requirements of this order in accordance with the manufacturer's statement of conformance outlined below. This identification will be accepted by the Civil Aeronautics Administration as evidence that the established minimum safety requirements for aircraft fabric have been met.

(2) *Data requirements.* None.

(3) *Effective date.* After September 1, 1948, specifications contained in this Technical Standard Order will constitute the basis for Civil Aeronautics Administration approval of "intermediate" grade fabric for use on certificated aircraft.

(4) *Deviations.* Requests for deviation from, or waiver of, the requirements of this order, which affect the basic airworthiness of the component, should be submitted for approval by the Director, Aircraft Service, Office of Aviation Safety, Civil Aeronautics Administration. These requests should be addressed to the nearest regional office of the Civil Aeronautics Administration, Attn: Superintendent, Aircraft Branch.

(5) *Conformance.* (i) The manufacturer shall furnish to the Civil Aeronautics Administration, Aircraft Service, Attn: A-298, Washington 25, D. C., a written statement of conformance signed by a responsible official of his company, setting forth that the "intermediate" grade fabric to be manufactured by him meets the minimum safety requirements established in this order. Immediately thereafter, distribution of the aircraft fabric conforming to the terms of this order may be started and continued.

(ii) The prescribed identification on the aircraft fabric does not relieve the aircraft manufacturer or owner of responsibility for the proper application of the aircraft fabric on his aircraft, nor waive any of the requirements concerning type certification of the aircraft in accordance with existing Civil Air Regulations.

(iii) If complaints of nonconformance with the requirements of this order are brought to the attention of the Civil Aeronautics Administration, and investigation indicates that such complaints are justified, the Administrator will take appropriate action to restrict the use of the product involved.

[1] Copies may be obtained from the Society of Automotive Engineers, 29 West 39th St., New York, N. Y.

(iv) Copies of this Technical Standard Order and other Technical Standard Orders may be obtained from the Civil Aeronautics Administration, Aviation Information Staff, Washington 25, D. C.

[13 F. R. 7726]

§ 4b.302-2 *Technical Standard Order TSO-C15: "Aircraft Fabric, Grade 'A,' External Covering Material"* (*CAA rules which apply to § 4b.302*)—(a) *Introduction.* (1) Aircraft fabric is in the class of aircraft components which the Administrator of Civil Aeronautics is authorized to approve in accordance with Parts 3, 4a and 4b of this subchapter.

(2) This Technical Standard Order is intended to serve as a criterion by which the product manufacturer can obtain Civil Aeronautics Administration approval of his aircraft fabric.

(3) In the establishment of this Technical Standard Order, consideration has been given to existing Government and industry standards for aircraft fabric for the purpose of adopting the performance requirements of one of the recognized aeronautical standards as the minimum safety requirements for Grade "A" fabric which is intended for use as external covering material on civil aircraft or components thereof. The specifications of the Society of Automotive Engineers for Grade "A" fabric contains such requirements.

(b) *Directive.*

(1) *Provision.* Pursuant to §§ 3.31, 3.320, 4a.31, 4a.252, 4a.338, 4b.41, 4b.302, and 4b.332 of this subchapter, which authorize the Administrator to approve aircraft material, the performance requirements for Grade "A" fabric as set forth in section 5 of SAE Specification AMS 3806, Cloth; Airplane, Cotton, Mercerized, dated January 1, 1946,[1] stated below, are hereby established as the minimum safety requirements for Grade "A" fabric which is intended for external use on civil aircraft.

1. *Acknowledgment.* A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.

2. *Application.* The cloth shall be suitable for covering aircraft surfaces such as wings, fuselage, ailerons, and elevators.

3. *Material.* The cloth shall be woven from 2-ply, combed cotton yarn.

4. *Quality.* (a) The cotton fibers shall be evenly spun into yarns of proper and uniform yard count, twist, and diameter to produce the texture and weight required.

(b) The yarn shall be reasonably free from nap breaks, broken ends, uneven threads and knots.

(c) Yarns shall be closely woven into fabric uniform in body and appearance, and which shall be reasonably free from striations due to variable weaving operations. Cloth shall be uniformly finished in accordance with the best practice for high-grade airplane cloth.

5. *Requirements.* (a) The cloth shall be piece mercerized, or the yarn may be mercerized under tension.

(b) The weave shall be plain (one up and one down).

(c) The number of threads shall be not more than 84 and not less than 80 per inch in either the warp or the fill.

(d) The selvage edges shall be flat woven with no greater tension than that of the body of the cloth.

(e) The breaking strength shall be not less than 80 pounds per inch of width in either the warp or fill as determined by the ravelled-strip method.

(f) The elongation shall be not greater than 13% in the warp and not greater than 11% in the fill when 70 pounds tension is applied during the ravelled-strip test.

(g) The tearing strength shall be not less than 5 pounds in either the warp or fill as determined by the trapezoid method.

(h) The weight of the finished cloth shall not exceed 4.0 ounces per square yard for 36 and 42 inch widths and 4.5 ounces per square yard for 60 inches and over.

(i) The cloth shall contain not more than 2.5% total sizing, finishing and other non-fibrous materials and should be chemically neutral. A desizing operation may be performed if necessary to reduce the sizing content to the 2.5% maximum value specified.

(j) Finishing shall consist of washing, framing and calendering. The calendering shall be sufficient to lay any nap present and shall provide a smooth, even surface. Nap may be removed by singeing.

6. *Tests.* All tests shall be made in accordance with ASTM D39-39 except as follows: The test for total sizing, finishing and other non-fibrous materials shall be made in accordance with ASTM D629-42T, using equation 3 for calculation.

7. *Tolerances.* Unless otherwise specified on the drawing or purchase order, the following tolerances apply:

Width (inches):	*Tolerance (inches)*
36	±½
42	±⅝
60	±1
69	±1
90	±1½

8. *Length of cut.* The length of a single cut shall be not less than 40 yards except that 10% of the total yardage of one width under any contract or order may be in short lengths of from 10 to 25 yards and 10% may be from 25 to 40 yards. However, short lengths shall be rolled together and the roll properly labeled to indicate that it is composed of short lengths.

9. *Length of roll.* The cloth shall be furnished on rolls containing the following lengths:

Width (inches):	*Roll length (yards)*
36 and 42	500 to 600
60 and 69	250 to 300
90	175 to 200

10. *Reports.* Unless otherwise specified, the vendor shall furnish for each shipment three copies of a notarized report stating that the cloth conforms to this specification. This report shall include the purchase order number, material specification number and quantity.

11. *Identification.* The cloth shall incorporate a continuous marking to show the manufacturer's name or trade-mark and AMS 3806. This marking may be stamped along the selvage.

12. *Packaging.* (a) Packaging shall be accomplished in such a manner as to insure that the cloth, during shipment or storage, will be protected against exposure to moisture or weathering, or harmful agents of any kind.

(b) Each package shall be permanently and legibly marked to give the following information:

Cloth: airplane, cotton, mercerized, 80 lbs. Breaking Strength AMS 3806
Yardage ______
Width ______
Date of Manufacture ______
Order number ______
Manufacturer's name ______

13. *Approval.* A vendor shall not supply cloth to this specification until samples are approved by the purchaser and, after approval, the materials and/or methods of manufacture shall not be changed without written permission from the purchaser. Results of tests on incoming shipments shall be essentially equal to those on the approved samples.

14. *Rejections.* Cloth not conforming to this specification or to authorized modifications shall be subject to rejection. Unless otherwise stipulated, rejected cloth will be returned to vendor at vendor's expense, unless purchaser receives, within three weeks of notification of rejection, other instructions for disposition.

NOTE: *Similar specification.* ANC-121 is listed for information only and shall not be construed as an acceptable alternate unless all requirements of this AMS are met.

(2) *Application.* Fabric complying with the specifications appearing in this order is approved for all aircraft with wing loadings greater than 9 pounds per square foot and placard never-exceed speeds greater than 160 miles per hour. Fabric already approved by the Administrator may continue to be installed on aircraft:

(i) For which an application for original type certificate is made prior to the effective date of this order,

(ii) The prototype of which is flown within 1 year after the effective date of this order, and

(iii) The prototype of which is not flown within 1 year after the effective date of this order if due to causes beyond the applicant's control.

(c) *Specific instructions.*

(1) *Marking.* In addition to the identification information required in the referenced specification, the Technical Standard Order designation "CAA-TSO-C15" shall be marked continuously along the selvage edge of the cloth, except that for the purposes of this order, inclusion of the AMS number 3806 is not required. This will identify the fabric as meeting the requirements of this order in accordance with the manufacturer's statement of conformance outlined below. This identification will be accepted by the Civil Aeronautics Administration as evidence that the established minimum safety requirements for aircraft fabric have been met.

(2) *Data requirements.* None.

(3) *Effective date.* After September 1, 1948, specifications contained in this Technical Standard Order will constitute the basis for Civil Aeronautics Administration approval of Grade "A" fabric for use on certificated aircraft.

(4) *Deviations.* Requests for deviation from, or waiver of, the requirements of this order, which affect the basic airworthiness of the component, should be submitted for approval by the Director, Aircraft Service, Office of Aviation Safety, Civil Aeronautics Administration. These requests should be addressed to the nearest regional office of the Civil Aeronautics Administration, Attn: Superintendent, Aircraft Branch.

(5) *Conformance.* (i) The manufacturer shall furnish to the Civil Aeronautics Administration, Aircraft Service, Attn: A-298, Washington 25, D. C., a written statement of conformance signed by a responsible official of his company,

[1] Copies may be obtained from the Society of Automotive Engineers, 29 West 39th St., New York, N. Y.

setting forth that the Grade "A" aircraft fabric to be manufactured by him meets the minimum safety requirements established in this order. Immediately thereafter, distribution of the aircraft fabric conforming to the terms of this order may be started and continued.

(ii) The prescribed identification on the aircraft fabric does not relieve the aircraft manufacturer or owner of responsibility for the proper application of the aircraft fabric on his aircraft, nor waive any of the requirements concerning type certification of the aircraft in accordance with existing Civil Air Regulations.

(iii) If complaints of nonconformance with the requirements of this order are brought to the attention of the Civil Aeronautics Administration, and investigation indicates that such complaints are justified, the Administrator will take appropriate action to restrict the use of the product involved.

(iv) Copies of this Technical Standard Order and other Technical Standard Orders may be obtained from the Civil Aeronautics Administration, Aviation Information Staff, Washington 25, D. C.

[13 F. R. 7727]

§ 4b.303 *Fabrication methods.* The methods of fabrication employed in constructing the airplane structure shall be such as to produce a uniformly sound structure. When a fabrication process such as gluing, spot welding, or heat treating requires close control to attain this objective, the process shall be performed in accordance with an approved process specification.

§ 4b.304 *Standard fastenings.* All bolts, pins, screws, and rivets used in the structure shall be of an approved type. The use of an approved locking device or method is required for all such bolts, pins, and screws. Self-locking nuts shall not be used on bolts which are subject to rotation in operation.

§ 4b.305 *Protection.* 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. In seaplanes, special precaution shall be taken against corrosion from salt water, particularly where parts made from different metals are in close proximity. Adequate provisions for ventilation and drainage shall be made.

§ 4b.306 *Inspection provisions.* Adequate means shall be provided to permit the close examination of such parts of the airplane as require periodic inspection, adjustments for proper alignment and functioning, and lubrication of moving parts.

STRUCTURAL PARTS

§ 4b.311 *Material strength properties and design values.* 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. The design values shall be so chosen that the probability of any structure being understrength because of material variations is extremely remote. ANC-5[1] values and ANC-18[1] shall be used unless shown to be inapplicable in a particular case.

§ 4b.312 *Special factors.* Where there may be uncertainty concerning the actual strength of particular parts of the structure, or where the strength is likely to deteriorate in service prior to normal replacement, increased factors of safety shall be provided to insure that the reliability of such parts is not less than the rest of the structure as specified in §§ 4b.313-4b.316.

§ 4b.313 *Variability factor.* For parts whose strength is subject to appreciable variability due to uncertainties in manufacturing processes and inspection methods, the factor of safety shall be increased sufficiently to make the probability of any part being understrength from this cause extremely remote. Minimum variability factors (only the highest pertinent variability factor need be considered) are as follows:

(a) *Castings.* (1) Where visual inspection only is to be employed, the variability factor shall be 2.0.

(2) The variability factor may be reduced to 1.25 for ultimate loads and 1.15 for limit loads when at least three sample castings are tested to show compliance with these factors, and all sample and production castings are visually and radiographically inspected in accordance with an approved inspection specification.

(3) Other inspection procedures and variability factors may be used if approved by the Administrator.

§ 4b.314 *Bearing factors.* (a) The factor of safety in bearing at bolted or pinned joints shall be suitably increased to provide for the following conditions (values in ANC-5 are acceptable):

(1) Relative motion in operation. (Control surface and system joints are covered in §§ 4b.341-4b.343 and 4b.351-4b.368.)

(2) Joints with clearance (free fit) subject to pounding or vibration.

(b) Bearing factors need not be applied when covered by other special factors.

§ 4b.315 *Fitting factor.* Fittings are defined as parts such as end terminals used to join one structural member to another. A multiplying factor of safety of at least 1.15 shall be used in the analysis of all fittings whose strength 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 applies to all portions of the fitting, the means of attachment, and bearing on the members joined. In the case of integral fittings, the part shall be treated as a fitting up to the point where the section properties become typical of the member. The fitting factor need not be applied where a type of joint design based on comprehensive test data is used. The following are examples: Continuous joints in metal plating, welded joints, and scarf joints in wood, all made in accordance with approved practices.

§ 4b.316 *Fatigue strength.* The structure shall be designed in so far as practicable, to avoid points of stress concentration where variable stresses above the fatigue limit are likely to occur in normal service.

FLUTTER, VIBRATION, AND STIFFNESS

§ 4b.321 *Flutter and vibration prevention measures.* (a) Wings, tail surfaces, control surfaces, control systems, and other structural parts shall be free from flutter and all dangerous vibration, including that resulting from gust impulses, for all conditions of operation within the limit *V-n* envelope (see § 4b.171 for required flight demonstration). In addition to this flight demonstration, satisfactory analytical and/or experimental evidence shall be submitted to show that dangerous flutter conditions would not develop at any speed up to 1.2 V_d chosen in accordance with § 4b.189 except that the speed need not exceed the terminal velocity in a 30° dive.

(b) In showing compliance with this section:

(1) The natural frequencies of all main structural components, control surfaces and systems shall be determined by vibration tests or other satisfactory methods, and shall be shown to be within the range of values satisfactory for the prevention of flutter.

(2) The mass balance of movable control surfaces shall be shown to be such as to preclude flutter. If concentrated balance weights are used to balance control surfaces, their location and the stiffness of their supports shall be shown adequate to render them effective.

(3) Control surface tabs not equipped with a rugged irreversible actuating mechanism, as specified in § 4b.353, shall be properly mass balanced and shown to be free from flutter tendencies by a rational flutter analysis or equivalent testing.

§ 4b.322 *Stiffness.* Wings and tail surfaces shall be shown to be free from aero-elastic divergence, and control surfaces to be free from reversal of effect, at all speeds up to 1.2V_d chosen in accordance with § 4b.189, except that the speed need not exceed the terminal velocity in a 30° dive. In showing compliance with this section, the torsional rigidity of wings and tail surfaces shall be determined by tests or other acceptable methods.

WINGS

§ 4b.331 *External bracing.* When wires are used for external lift bracing, they shall be double unless the design provides for a lift-wire-cut condition. Rigging loads shall be taken into account in a rational or conservative manner. The end connections of brace wires shall be such as to minimize restraint against bending or vibration. When brace struts of large fineness ratio are used, the aerodynamic forces on such struts shall be taken into account.

[1] ANC-5, "Strength of Aircraft Elements" and ANC-18, "Design of Wood Aircraft Structures," are published by the Army-Navy-Civil Committee on Aircraft Design Criteria and may be obtained from the Government Printing Office, Washington 25, D. C., for $0.35 and $0.25, respectively.

§ 4b.332 *Covering.* Strength tests of fabric covering are required unless approved grades of cloth, methods of support, attachment and finishing are employed. Special tests may be required when it appears necessary to account for the effects of unusually high design air speeds, slipstream velocities, or other unusual conditions.

§ 4b.332-1 *Aircraft fabric (CAA rules which apply to § 4b.332).* See §§ 4b.302-1 and 4b.302-2.

[13 F. R. 7728]

CONTROL SURFACES (FIXED AND MOVABLE)

§ 4b.341 *Proof of strength.* Limit load tests are required to prove compliance with limit load requirements. Control surface tests shall include the horn or fitting to which the control system is attached. Analysis or individual load tests shall be conducted to demonstrate compliance with the multiplying factor of safety requirements for control surface hinges. Rigging loads due to wire bracing shall be taken into account in a rational or conservative manner. The end connections of brace wires shall be such as to minimize restraint against bending or vibration.

§ 4b.342 *Installation.* Movable tail surfaces shall be so installed that there is no interference between the surfaces of their bracing when each is held in its extreme position and all others are operated through their full angular movement. When an adjustable stabilizer is used, stops shall be provided which will limit its travel, in the event of failure of the adjusting mechanism, to a range equal to the maximum required to trim the airplane in accordance with § 4b.136.

§ 4b.343 *Hinges.* Control surface hinges, excepting ball and roller bearings, shall incorporate a multiplying factor of safety of not less than 6.67 with respect to the ultimate bearing strength of the softest material used as a bearing. For hinges incorporating ball or roller bearings, the approved rating of the bearing shall not be exceeded. Hinges shall provide sufficient strength and rigidity for loads parallel to the hinge line.

CONTROL SYSTEMS

§ 4b.351 *General.* All controls shall operate with sufficient ease, smoothness, and positiveness to permit the proper performance of their function and shall be so arranged and identified as to provide satisfactory convenience in operation and prevent possibility of confusion and subsequent inadvertent operation.

§ 4b.352 *Primary flight controls.* Primary flight controls are defined as those used by the pilot for the immediate control of the pitching, rolling, and yawing of the airplane. Two-control airplanes shall be capable of continuing safely in flight and landing in spite of the failure of any one connecting element in the primary directional-lateral flight control system.

§ 4b.353 *Trimming controls.* The trimming controls shall be conveniently located and each shall operate in the plane and with the sense of the motion of the airplane which its operation is intended to provide, as specified in § 4b.423. Proper precautions shall be taken against the possibility of inadvertent or abrupt tab operation. Means shall be provided, adjacent to the control to indicate to the pilot the direction of the control movement in relation to the airplane motion and the positions of the trim device with respect to the range of adjustment. Trimming devices shall be capable of continued normal operation in spite of the failure of any one connecting or transmitting element in the primary flight control system. Tab controls shall be irreversible unless the tab is properly balanced and investigated for flutter. Irreversible tab systems shall provide adequate rigidity and reliability in the portion of the system from the tab to the attachment of the irreversible unit to the airplane structure.

§ 4b.354 *Wing flap controls.* The wing flap control shall provide means for bringing the flaps from any position within the operating range to any one of the take-off, en route, approach, and landing positions specified in §§ 4b.91–4b.114. The control shall operate in such a manner as to permit the flight crew to place the flap in any of these positions readily and surely and to maintain these positions thereafter without further attention on the part of the crew. The flap control shall operate in the directions specified in § 4b.423 and shall be so located and designed as to render improbable its inadvertent operation. (See Fig. 4b–17.) The rate of motion of the flap in response to the operation of the control shall be such as to permit compliance with the requirements of § 4b.127 (c) and (d). The control shall be so designed as to be capable of retracting the flaps from the fully extended position during steady flight drawing maximum continuous power at all speeds from V_{sf} to V_f plus 10 miles per hour. Means shall be provided to indicate the flap position to the pilot and the indicator shall show the take-off, en route, approach, and landing positions. If any extension of the flaps beyond the landing position is possible, the flap control shall be clearly marked to identify such range of extension. Adequate instructions for the proper operation of the wing flaps shall be included in the airplane operating manual required by §§ 4b.911–4b.926.

4b.355 *Flap interconnection.* The motion of flaps on opposite sides of the plane of symmetry shall be synchronized by a mechanical interconnection unless the airplane is demonstrated to have safe flight characteristics while the flaps are retracted on one side and extended on the other. Where an interconnection is used, it shall be designed to account for the unsymmetrical loads resulting from flight with the engines on one side of the plane of symmetry inoperative and the remaining engines at take-off power. For single-engined airplanes, it may be assumed that 100% of the critical air load acts on one side and 70% on the other.

§ 4b.356 *Stops.* All control systems shall be provided with stops which positively limit the range of motion of the control surfaces. Stops shall be so located in the system that wear, slackness, or take-up adjustments will not appreciably affect the range of surface travel. Stops shall be capable of withstanding the loads corresponding to the design conditions for the control system.

§ 4b.357 *Control system locks.* (a) When a device is provided for locking a control surface while the airplane is on the ground or water:

(1) The locking device shall be so installed as to provide unmistakable warning to the pilot when it is engaged,

(2) Means shall be provided to preclude the possibility of the lock becoming engaged during flight.

(b) Such locks shall be designed for the ground gust conditions of § 4b.233.

§ 4b.358 *Proof of strength.* Tests are required to prove compliance with limit load requirements. The direction of test loads shall be such as to produce the most severe loading of the control system structure. The tests shall include all fittings, pulleys, and brackets used to attach the control system to the primary structure. Analyses or individual load tests shall be conducted to demonstrate compliance with the multiplying factor of safety requirements specified for control system joints subjected to angular motion.

§ 4b.359 *Operation test.* An operation test shall be conducted by operating the controls from the pilot's compartment with the entire system so loaded as to correspond to 80% of the limit load specified for the control system in question. In this test there shall be no jamming, excessive friction, or excessive deflection.

CONTROL SYSTEM DETAILS

§ 4b.366 *General.* All control systems and operating devices shall be so designed and installed as to prevent jamming, chafing, or interference from cargo, passengers, or loose objects as a result of inadequate clearances. Special precautions shall be provided in the cockpit to prevent the entry of foreign objects into places where they might jam the controls. Provisions shall be made to prevent the slapping of cables or tubes against parts of the airplane.

§ 4b.367 *Cable systems.* Cables, cable fittings, turnbuckles, splices, and pulleys shall be in accordance with approved specifications. Cables smaller than ⅛-inch diameter shall not be used in the primary control system. The design of cable systems shall be such that there will not be a hazardous change in cable tension throughout the range of travel under operating conditions and temperature variations. Pulley types and sizes shall correspond to the cables with which they are used, as specified on the pulley specification. All pulleys shall be provided with satisfactory guards which shall be closely fitted to prevent the cables becoming misplaced or fouled even when slack. The pulleys shall lie in the plane passing through the cable within such limits that the cable does not rub against the pulley flange. Fairleads shall be so installed that they are not required to cause a change in cable direction of more than 3°. Clevis pins (excluding those not subject to load or motion) retained only by cotter pins shall not be employed in the control system. Turnbuckles shall be attached to parts having angular motion in such a manner as to prevent positively any binding throughout the range of travel. Provisions for visual inspection shall be made at fairleads, pulleys, terminals, and turnbuckles.

§ 4b.368 *Joints.* Control system joints subjected to angular motion in push-pull systems, excepting ball and roller bearing systems, shall incorporate a multiplying factor of safety of not less than 3.33 with respect to the ultimate bearing strength of the softest material used as a bearing. This factor may be reduced to 2.0 for such joints in cable control systems. For ball or roller bearings the approved rating of the bearings shall not be exceeded.

Landing Gear

SHOCK ABSORBERS

§ 4b.371 *Tests.* Main, nose, and tail wheel units shall incorporate shock absorbing elements which shall be substantiated by the tests specified in §§ 4b.372–4b.375. In addition, the shock absorbing ability of the landing gear in taxying must be demonstrated in the operational tests of § 4b.164.

§ 4b.372 *Shock absorption tests.* (a) It shall be demonstrated by energy absorption tests that the limit load factors selected for design in accordance with § 4b.243 for take-off and landing weights respectively would not be exceeded under the critical landing conditions specified in that section.

(b) In addition, a reserve of energy absorption shall be demonstrated by a test simulating an airplane descent velocity of 12 feet per second at design landing weight, assuming wing lift not greater than the airplane weight acting during the landing impact. In this test the landing gear shall not fail.

§ 4b.373 *Limit drop tests.* (a) If compliance with the specified limit landing conditions of § 4b.372 (a) is demonstrated by free drop tests, these shall be conducted on the complete airplane, or on units consisting of wheel, tire, and shock absorber in their proper relation, from free drop heights not less than the following:

(1) 18.7 inches for the design landing weight conditions.

(2) 6.7 inches for the design take-off weight conditions.

(b) To simulate wing lift in free drop tests the landing gear shall be dropped with an effective mass equal to:

$$W_e=\frac{Wh+(1-L)d}{h+d}$$

where:

W_e = the effective weight to be used in the drop test.

h = specified height of drop in inches.

d = deflection under impact of the tire (at the approved inflation pressure) plus the vertical component of the axle travel relative to the drop mass. The value of d used in the computation of W_e shall not exceed the value actually obtained in the drop test.

$W=W_M$ for main units, equal to the static weight on the particular unit with the airplane in the level attitude (with the nose wheel clear, in the case of nose wheel type airplanes).

$W=W_T$ for tail gear units, equal to the static weight on the tail unit with the airplane in the tail down attitude.

$W=W_N$ for nose wheel units, equal to the static reaction which would exist at the nose wheel, assuming the mass of the airplane acting at the center of gravity and exerting a force of 1.0 g downward and 0.25 g forward.

L = the ratio of the assumed wing lift to the airplane weight, not in excess of 0.667.

(c) The attitude in which a landing gear unit is drop tested shall be such as to simulate the airplane landing condition which is critical from the standpoint of energy to be absorbed by the particular unit.

§ 4b.374 *Limit load factor determination.* (a) In determining the limit airplane inertia load factor, n, from the free drop tests described above, the following formula shall be used:

$$n=n_j\frac{W_e}{W}+L$$

where:

n_j = the load factor developed in the drop test, that is, the acceleration (dv/dt) in g's is recorded in the drop test, plus 1.0.

(b) The value of n so determined shall not be greater than the limit load factor used in the landing conditions, § 4b.243.

§ 4b.375 *Reserve energy absorption drop tests.* If compliance with the reserve energy absorption condition specified in § 4b.372 (b) is demonstrated by free drop tests, the landing gear units shall be dropped from a free drop height of not less than 27 inches. If it is desired to simulate wing lift equal to the airplane weight, the units shall be dropped with an effective mass equal to

$$W_e=W\frac{h}{h+d}$$

where the symbols and other details are the same as in § 4b.373.

RETRACTING MECHANISM

§ 4b.381 *General.* The landing gear retracting mechanism and supporting structure shall be designed for the loads occurring in the flight conditions when the gear is in the retracted position. It shall also be designed for the combination of friction, inertia, brake torque, and air loads occurring during retraction and extension at any air speed up to 1.6 V_{s_1} (flaps in the approach position at design landing weight), and any load factors up to those specified for the flaps-extended condition, § 4b.193. The landing gear, retracting mechanism, and airplane structure, including wheel well doors, shall be designed to withstand the flight loads occurring with the landing gear in the extended position at any speed up to 0.67 V_C unless other means are provided to decelerate the airplane in flight at this speed. Positive means shall be provided for the purpose of maintaining the wheels in the extended position.

[Amdt. 04–0, 11 F. R. 71, as amended by Amdt. 04b–5, 12 F. R. 3933]

§ 4b.382 *Emergency operation.* Emergency means of extending the landing gear shall be provided, so that the landing gear can be satisfactorily extended in the event of any reasonably probable failure in the normal retraction system. The emergency system shall provide for the failure of any single source of hydraulic, electric, or equivalent energy supply.

§ 4b.383 *Operation test.* Proper functioning of the landing gear retracting mechanism shall be demonstrated by operation tests.

§ 4b.384 *Position indicator and warning device.* When retractable landing wheels are used, means shall be provided for indicating to the pilot when the wheels are secured in either extreme position. In addition, landplanes shall be provided with an aural warning device which shall function continuously after all throttles are closed until the gear is down and locked. If a manual shut-off for the warning device is provided, it shall be arranged so that reopening the throttles will render the warning device effective again, as specified above.

§ 4b.385 *Control.* The landing gear retraction control shall be located and shall operate as described in § 4b.423.

WHEELS AND TIRES

§ 4b.391 *Wheels.* Main landing gear wheels (i. e. those nearest the airplane center of gravity) shall be of an approved type in accordance with Part 15 of this subchapter. The rated static load of each main wheel shall not be less than the design take-off weight, divided by the number of main wheels. Nose wheels shall be tested in accordance with Part 15 of this subchapter for an ultimate radial load of not less than the maximum nose wheel ultimate loads obtained in the ground loads requirements, and for the corresponding side and burst loads specified in Part 15 of this subchapter.

§ 4b.392 *Tires.* (a) A landing gear wheel may be equipped with any make or type of tire: *Provided,* That the tire is a proper fit on the rim of the wheel, *And provided,* That the approved tire rating is not exceeded under the following conditions:

(1) Airplane weight equal to the design take-off weight.

(2) Loan on main wheel tires equal to the airplane weight divided by the number of wheels.

(3) Load nose wheel tires (to be compared with the dynamic rating established for such tires) equal to the reaction obtained at the nose wheel, assuming the mass of the airplane concentrated at the center of gravity and exerting a force of 1.0 g downward and 0.31 g forward, the reactions being distributed to the nose and main wheels by the principles of statics with the drag reaction at the ground applied only at those wheels having brakes. When specially constructed tires are used to support an airplane, the wheels shall be plainly and conspicuously marked to that effect. Such markings shall include the make, size, number of plies, and identification marking of the proper tire.

(b) Approved ratings are those assigned by the Tire and Rim Association or by the Administrator.

BRAKES

4b.396 *General.* All airplanes shall be equipped with brakes certificated in accordance with the provisions of Part 15 of this subchapter for the maximum certificated landing weight at sea level and the power-off stalling speed, V_{s_0}, as defined in § 4b.93. The brake system shall be so designed and constructed that in the event of a single failure in any connection or transmitting element in the brake system (excluding the operating pedal or handle), or the loss of any single source of hydraulic or other brake operating energy supply, it shall be possible, as shown by suitable test or other data, to bring the airplane to rest under conditions specified in §§ 4b.111–4b.114 with a mean negative acceleration during the landing roll of at least 50 percent of that obtained in determining the landing distance under that section. In applying the requirements of §§ 4b.396–4b.398 to hydraulic brakes, the brake drum, shoes, and actuators (or their equivalents) shall be considered as connecting or transmitting elements unless it is shown that the leakage of hydraulic fluid resulting from failure of the sealing elements in these units would not reduce the braking effectiveness below that specified in this section.

§ 4b.396–1 *Reverse thrust as substitute for dual brake system (CAA policies which apply to § 4b.396).* The Administrator will permit the use of reverse thrust to show that a duplicate set of wheel brakes is unnecessary, only if it can be shown that such use provides a level of safety equivalent to that contemplated by the present regulations when wheel brakes alone are used, including proper consideration of pilot skill required and likelihood of attaining the necessary performance under conditions of simulated brake failure.

[12 F. R. 3438. Correction noted at 14 F. R. 37]

§ 4b.397 *Parking brake.* A parking brake control shall also be provided which may be set by the pilot and, without further attention, maintain braking sufficient to prevent the airplane from rolling on a paved runway while applying take-off power on the most critical engine.

§ 4b.398 *Brake controls.* Brake controls shall not require excessive control forces in their operation.

SKIS

§ 4b.406 *Requirements.* Skis shall be certificated in accordance with the ski requirements of Part 15 of this subchapter. The approved rating of the skis shall not be less than the maximum take-off weight of the airplane on which they are installed.

§ 4b.407 *Installation.* (a) The ski installation shall be made in accordance with the ski or airplane manufacturer's recommendations which shall have been approved by the Administrator.

(b) In addition to such shock cord(s) as may be provided, front and rear check cables shall be used on skis not equipped with special stabilizing devices.

§ 4b.408 *Tests.* It shall be demonstrated that the airplane has satisfactory landing and taxying characteristics and that the airplane's flight characteristics are not impaired by the installation of the skis.

HULLS AND FLOATS

§ 4b.416 *Buoyancy (main seaplane floats).* (a) Main seaplane floats shall have a bouyancy in excess of that required to support the gross weight of the airplane in fresh water as follows:

(1) 80% in the case of single floats.

(2) 90% in the case of double floats.

(b) Main seaplane floats shall contain at least 5 watertight compartments of approximately equal volume.

§ 4b.417 *Buoyancy (boat seaplanes).* The hulls of boat seaplanes and amphibians shall be divided into watertight compartments such that with any 2 adjacent compartments flooded, the hull and auxiliary floats (and tires, if used) will retain sufficient buoyancy to support the gross weight of the aircraft in fresh water without capsizing. Bulkheads may have watertight doors for the purpose of communication between compartments.

FUSELAGE

PILOT COMPARTMENT

§ 4b.421 *General.* (a) The arrangement of the pilot compartment and its appurtenances shall provide a satisfactory degree of safety and assurance that the pilot will be able to perform all his duties and operate the controls in the correct manner without unreasonable concentration and fatigue.

(b) The primary flight controls units listed on Figure 4b–17, excluding cables and control rods, shall be so located with respect to the propellers that no portion of the pilot or controls lie in the region between the plane of rotation of any inboard propeller and the surface generated by a line passing through the center of the propeller hub and making an angle of 5 degrees forward or aft of the plane of rotation of the propeller.

(c) When a second pilot is required for particular operations by Parts 40, 41, and 61 of this subchapter the airplane shall be fully and readily controllable from each seat.

(d) The pilot compartment shall be so constructed as to prevent leakage likely to be distracting to the crew or harmful to the structure when flying in rain or snow. A door or an adequate openable window shall be provided between the pilot compartment and the passenger compartment. When a door is provided, it shall be equipped with a locking means which will prevent passengers from opening such door without the pilot's permission.

§ 4b.422 *Vision—(a) Nonprecipitation conditions.* The pilot compartment shall be arranged to afford the pilots a sufficiently extensive, clear, and undistorted view to perform safely all maneuvers within the operating limitations of the airplane, including taxying, take-off, approach, and landing. It shall be demonstrated by day and night flight tests that the pilot compartment is free of glare and reflections that would interfere with the pilot's vision.

(b) *Precipitation conditions* (1) At least the first pilot shall be afforded an adequate view along the flight path in normal flight, approach, and landing, by the provisional means for maintaining appropriate areas of the windshield clear without continuous attention by the crew during the following conditions of precipitation:

(i) In heavy rain at all speeds up to 1.6 V_{s_1}, flaps retracted.

(ii) In severe icing conditions, whenever de-icing provisions are required for the particular operations by Parts 40, 41, and 61 of this subchapter.

(2) In all cases, at least the first pilot shall be provided with a window which is openable under the above conditions and is so arranged as to afford, through the opening, a view as specified above, with sufficient protection from the elements that his vision is not impaired. The window need not be opened under pressurized conditions.

(c) *Pilot windshield and windows.* All internal glass panes shall be of a nonsplintering safety type.

(d) *Bird impact.* The windshield, its supporting structure, and other structure in front of the pilots shall have sufficient strength to withstand without penetration the impact of a 4-pound bird when the relative velocity of the bird to the airplane along the flight path of the latter is equal to the value of V_c at sea level chosen in accordance with § 4b.189.

§ 4b.423 *Cockpit arrangement.* (a) All cockpit controls shall be so located and, except for the primary controls, identified as to provide satisfactory convenience in operation including adequate provisions to prevent the possibility of confusion and consequent inadvertent operation. (See Figs. 4b–17 and 4b–18 for direction of movement of aerodynamic, and certain power-plant, accessory, and auxiliary controls.) Wherever practicable the sense of motion involved in the operation of other controls shall correspond with the sense of the effect of the operation upon the airplane or the part operated.

(b) The controls shall be so located and arranged with respect to the pilot's seat that it will be readily possible for the operator to obtain full and unrestricted movement of each control without interference from either the cockpit structure or the operator's clothing when seated. This shall be demonstrated for individuals ranging from 5'2" to 6'0" in height.

(c) Identical power-plant controls for the several engines shall be so located as to prevent any misleading impression as to the engines to which they relate.

§ 4b.424 *Instruments and markings.* (See § 4b.696 relative to instrument arrangement.) The operational markings, instructions, and placards required for the instruments, controls, etc., are specified in § 4b.881–4b.904.

§ 4b.425 *Noise and vibration.* Vibration and noise characteristics of cockpit appurtenances shall be suoh as not to interfere with the safe operation of the airplane.

Controls	Type of control	Movement and actuation
Primary:		
Aileron	Stick or Column with grip or wheel.	Right (clockwise) for right wing down.
Elevator		Rearward to pitch nose up.
Rudder	Foot pedals or rudder bar	Right pedal forward for nose right.
Secondary: Flaps or auxiliary lift devices.		Down to extend.
Trimming: Tabs or equivalent	Wheel (or Segment when actuation suggests rotary movement).	Rotate to produce similar rotation of the airplane about the axis which is parallel to the axis of the control being operated.

Wing flap or auxiliary lift device controls and the landing gear control shall be adequately separated to prevent confusion and subsequent inadvertent operation.

FIGURE 4b-17.—AERODYNAMIC CONTROLS.

Controls	Movement and actuation
Power plant:	
Throttles	Forward to increase power.
Propeller	Forward to increase revolutions per minute.
Mixture	Forward for rich.
Carburetor air heat	Forward for cold.
Auxiliary: Landing gear	Down to extend.

Wing flap or auxiliary lift device controls and the landing gear control shall be adequately separated to prevent confusion and subsequent inadvertent operation.

FIGURE 4b-18.—POWER-PLANT AND AUXILIARY CONTROLS.

EMERGENCY PROVISIONS

§ 4b.431 *Flotation.* (a) When certification of ditching provisions is desired under the provisions of § 4b.292, satisfactory evidence shall be submitted that there is every reasonable probability that the airplane, after landing in the water as specified in § 4b.292, would remain afloat, as follows:

(1) In the case of airplanes equipped with life rafts having capacity for all persons aboard the airplane, the floating time and trim would permit all occupants to leave their ditching stations and occupy the rafts.

(2) In the case of airplanes not equipped with life rafts having capacity for all persons aboard the airplane, the airplane would float indefinitely with sufficient compartments above the water line to accommodate all persons aboard the airplane.

(b) Compliance with the requirements of this section may be demonstrated by buoyancy and trim computations in which suitable allowances are made for probable structural damage and leakage. For airplanes equipped with fuel dump valves, the volume of fuel which could be dumped may be considered as buoyancy volume.

§ 4b.432 *Emergency exits.* Passenger and crew compartments designated as occupiable during take-off and landing shall be provided with emergency exits as specified in §§ 4b.433 and 4b.434. For the purposes of §§ 4b.432–4b.434, a compartment is defined as a closed space to which normal access is by a door, passageway, or stair that is likely to become a bottleneck in evacuating the airplane. In case of question concerning the adequacy and suitability of emergency exits, it shall be demonstrated that the airplane can be completely evacuated in 30 seconds, or in a time equal to 1 second per occupant, whichever is greater, under conditions simulating a forced landing. The maximum number of persons for which seats are provided shall be used in this demonstration. The persons demonstrating the evacuation procedure may be briefed once prior to the official demonstration.

§ 4b.433 *Number of exits.* (a) The minimum number of exits per compartment is as follows:

Number of persons for which seats are provided:	*Minimum number of exits required*
5 or less	1
Exceeding 5, not exceeding 15	2
Exceeding 15, not exceeding 22	3
Exceeding 22, not exceeding 29	4
Exceeding 29, not exceeding 36	5
Exceeding 36, not exceeding 50	6

(b) The external door specified in § 4b.441 may be counted as one emergency exit if it meets the detail requirements of § 4b.434.

(c) The number of exits in any one compartment need not exceed 4 if an adjacent compartment can be reached through a passageway without a door and if the total exits in the 2 compartments exceeds at least 1 exit per 8 passengers. Other numbers of exits may be used if it can be demonstrated that the airplane can be evacuated in the time specified in § 4b.432.

§ 4b.434 *Exit arrangement.* (a) At least the minimum number of exits specified in § 4b.433 shall be located so as to give the maximum likelihood of their being usable in the emergency landing with wheels up. When certification of ditching provisions is desired, it shall be shown that at least one emergency exit for every 16 passengers is located above the water line as determined in § 4b.431.

(b) In airplanes for which 2 or more exits are required, the ratio of the number of exits on either side to the total number required shall be not less than one-third. In such cases at least one exit on the opposite side from the main door shall be operable from the outside and shall be marked accordingly for the guidance of rescue personnel.

(c) The exits shall be readily accessible, shall not require exceptional agility of a person using them and shall be distributed so as to facilitate egress without crowding. Each exit shall provide a clear and unobstructed opening to the outside, the minimum dimensions of the opening shall be such that a 19 by 26 inch ellipse may be inscribed therein. Reasonable provisions shall be made against the jamming of exits as a result of fuselage deformation.

(d) The method of opening shall be simple and obvious and the exits shall be so arranged that they may be readily operated. (See § 4b.903.) The proper functioning of exits shall be demonstrated by test. At land plane exits which are more than 10 feet from the ground with the airplane on the ground and wheels retracted, suitable means shall be provided by which the occupants can safely descend to the ground.

PASSENGER AND CREW ACCOMMODATIONS

§ 4b.441 *External doors.* (a) Airplanes having closed cabins shall be provided with at least one adequate and easily accessible external main door. It shall be possible to open such door from either inside or outside by the operation of only one handle inside or one handle outside even though the persons using the exit may be crowded near it. The means of opening shall be simple and obvious and shall be so arranged and marked that it can be readily located and operated, even in darkness. Reasonable provisions shall be made to prevent the jamming of such door as a result of fuselage deformation in a minor crash.

(b) No door for regular use shall be so located that persons using it would be endangered by the propellers.

§ 4b.442 *Internal doors.* Where internal doors are equipped with louvres or other ventilating means, provision convenient to the crew shall be made for closing the flow of air through the door when such action is found necessary.

[Amdt. 04-1, 11 F. R. 11351]

§ 4b.443 *Seats, berths, and safety belts.*

(a) *Arrangement.* (1) At all stations designated as occupiable during take-off and landing, the seats, berths, belts or harness and surrounding parts of the airplane shall be so arranged that a person making proper use of the facilities provided would not suffer serious injury in the emergency landing conditions of §§ 4b.291 and 4b.292 as a result of contact of a vulnerable part of his body with any penetrating or relatively solid object. Passengers and crew shall be afforded protection from head injuries by one of the following or equivalent means:

(i) Safety belt and shoulder harness which will prevent the head from contacting any injurious object,

(ii) Safety belt and the elimination of all injurious objects within radius of the head in a fore and aft direction,

(iii) Safety belt and a cushioned rest which will properly support the arms, shoulders, head, and spine. This method may be applied to forward, sideward, and rearward facing seats.

(2) Suitable hand grips or rails shall be provided along aisles to enable passengers or crew members to steady themselves while using the aisles during moderately rough air flights. Any projecting objects likely to cause injury to persons

seated or moving about the airplane in normal flight shall be suitably padded.

(b) *Strength.* (1) All seats, berths, and supporting structure shall be designed for an occupant weighing at least 170 lbs. and the critical loads resulting from all specified flight load conditions.

(2) All seats and berths designated as occupiable during landing and take-off, and their supporting structure, shall also be designed for the loads resulting from the specified ground loads and the emergency landing conditions of §§ 4b.291 and 4b.292, including appropriate reactions from the safety belts or harness.

(3) Pilots' seats shall be designed for the reactions resulting from application of the pilot forces to the flight controls as specified in §§ 4b.231–4b.234.

§ 4b.445 *Ventilation and heating*—(a) *Ventilation.* (1) All passenger and crew compartments shall be suitably ventilated. Carbon monoxide concentration shall not exceed 1 part in 20,000 parts of air, and fuel fumes shall not be present.

(2) Where partitions between compartments are equipped with louvres or other means allowing air to flow between such compartments, provision convenient to the crew shall be made for closing the flow of air through the louvres or other means when such action is found necessary.

(b) *Combustion heaters.* Gasoline operated combustion heater installations shall comply with applicable parts of the power plant installation requirements covering fire hazards and precautions. All applicable requirements concerning fuel tanks, lines, and exhaust systems shall be considered.

[Amdt. 04-0, 11 F. R. 71, as amended by Amdt. 04-1, 11 F. R. 11351]

§ 4b.445-1 *Technical Standard Order TSO-C20: "Combustion Heaters" (CAA rules which apply to § 4b.445 (b))*—(a) *Introduction.* Under section 601 of the Civil Aeronautics Act of 1938, as amended, and §§ 3.31, 3.388 (b), 4a.31 and 4a.301 of this chapter, and §§ 4b.41 and 4b.445 (b), the Administrator of Civil Aeronautics is authorized to adopt standards for combustion heaters intended for use in civil aircraft. In adopting these standards, consideration has been given to existing Government and industry standards for combustion heaters.

(b) *Directive*—(1) *Provision.* The requirements for combustion heaters, as set forth in SAE Aeronautical Standard AS143B; Heaters, Airplane, Internal Combustion Heat Exchanger Type, dated February 1, 1949,[1] stated below, are hereby established as minimum safety standards for combustion heaters intended for use in civil aircraft:

1. *Purpose.* To specify standards covering minimum safety and performance requirements for internal combustion heaters and certain auxiliary devices which are considered necessary to the safety and performance of the heaters as used in aircraft. These standards are to be considered currently applicable and necessarily subject to revision from time to time due to rapid development of the aeronautical industry. The following standards are based on practical engineering requirements for such internal combustion heat exchanger type heaters as are now used on airplanes and for such as may be developed to meet later requirements.

2. *Scope.* These standards are written to cover internal combustion heat exchanger type heaters used in the following applications:

2.1 Cabin heating. (All occupied regions and windshield heating.)

2.2 Wing and empennage heating.

2.3 Engine and accessory heating. (When heater is installed as part of the aircraft.)

3. *Definition.* An internal combustion heat exchanger type heater as used for airplane heating is one that utilizes through a heat exchanger the heat produced by combustion of a fuel within the heater for the purpose of heating the air being supplied to the airplane.

4. *General requirements.*

4.1 *Heater components.* An internal combustion type heater shall include all of the following:

4.1.1 Combustion chamber and heat exchanger assembly.

4.1.2 Casing or shroud for combustion chamber and heat exchanger assembly.

4.1.3 Igniter.

4.1.4 Burner.

4.1.5 Ventilating air inlet.

4.1.6 Ventilating air outlet.

4.1.7 Combustion air inlet.

4.1.8 Exhaust outlet.

4.1.9 Fuel inlet.

4.2 *Additional devices.* In addition to the heater, the following additional devices are considered necessary to the safety and performance of the heater and will be covered in that respect by these standards. These devices may be furnished separately or as part of the heater. These standards do not cover all tests necessary on these devices, but only those required in their relationship to the heater.

4.2.1 Fuel system.

4.2.1.1 Fuel nozzle, restrictor, orifice, or equivalent.

4.2.1:2 Fuel shutoff valve.

4.2.1.3 Fuel filter.

4.2.2 Safety controls.

4.2.2.1 A device to prevent the heater from becoming overheated.

4.2.2.2 A device to prevent fuel flow to the heater when combustion air is insufficient for safe operation.

4.2.3 Ignition system. (Required for spark ignition only.)

4.2.3.1 Device to provide high voltage power.

4.2.3.2 High voltage ignition lead assembly or equivalent electrical linkage between high voltage device and spark plug.

4.3 *Materials and workmanship.*

4.3.1 The heater and auxiliary equipment shall be constructed throughout of materials which are considered acceptable for the particular use intended and shall be made and furnished with a degree, uniformity, and grade of workmanship generally accepted in the aircraft industry.

4.3.2 The heater casing or shroud shall be constructed of fireproof material.

4.4 *Design features.*

4.4.1 The design shall be such as to preclude the possibility of discharging harmful concentrations of carbon monoxide into the ventilating air stream. See test, paragraph 6.5.4.1.

4.4.2 Where specified, the design shall be such as to preclude excessive loss of pressurized fuselage air. See test, paragraphs 6.5.4.2 and 6.5.4.3.

4.4.3 The design shall include protection against excessive radio interference. See test, section 6.4.

4.4.4 The design shall be such as to preclude harmful effects on construction or performance due to vibration. See test, section 6.3.

4.4.5 The design shall be such that the life of the heater and accompanying devices shall be comparable to other similar airframe components and accessories. See test, section 6.5.

4.4.6 Unless otherwise specified, the design shall be such that the heater and accompanying devices shall operate satisfactorily within normal ranges of power, fuel, and air supplies available in aircraft.

4.5 *Heater identification.* The following minimum information shall be legibly and permanently marked on the heater or on a nameplate attached thereto:

(a) Manufacturer's name and/or trademark.

(b) Manufacturer's part number.

(c) Manufacturer's serial number.

(d) SAE rated output, ______ B. t. u. hr. (See section 5.1)

(e) Rated fuel pressure, ______ psig.

(f) Electrical characteristics.

(g) SAE Spec. AS-143B. For Use: Unpr. cabin ______, Press. cabin ______. Wing ______. (Stamp "X" in one or more blanks as applicable.)

5. *Detail requirements.*

5.1 *SAE rating conditions.* Heater shall deliver at least SAE rated output at following conditions:

5.1.1 Sea level ambient pressure.

5.1.2 Rated fuel pressure, as specified by manufacturer.

5.1.3 Rated sea level combustion air rate, as specified by manufacturer.

5.1.4 Ventilating air temperature rise of 250° F.

5.1.5 Inlet temperature of fuel and air between 50° F. and 125° F.

5.2 *Air supply.*

5.2.1 When sufficient combustion or ventilating air for safe operation is not available the heater shall be made automatically inoperative. See tests, paragraphs 6.5.7.1 and 6.5.7.2.

5.2.2 The combustion air and ventilating air inlets on the heater shall be separated from each other.

5.3 *Fuel supply.*

5.3.1 The fuel lines and fittings under pressure in the heater shall be enclosed in such manner as to prevent any fuel leakage from entering the ventilating air stream, and the enclosure shall have adequate provision for draining to the combustion chamber or to a fuel drain fitting.

5.3.2 A fuel drain outlet or equivalent safety device shall be provided to prevent accumulation of fuel in the combustion chamber and heat exchanger assembly in case the fuel flows without igniting.

5.3.3 All fuel lines in the heater shall be constructed of steel or other fire resistant material. Where flexibility is required in these lines, flexible fire resistant coupled hose assemblies shall be used to eliminate the possibility of using hose clamp connections. Connections in metal fuel lines shall not employ solder nor other relatively low melting point materials which cannot withstand a 2000° F. flame for five minutes.

5.3.4 All gaskets, synthetic rubber seals, etc. shall be suitable for use with aromatic fuels and shall be satisfactory for use at the temperatures encountered within the overheating limits of the heater.

5.3.5 The fuel system lines, fittings and controls shall be sufficiently isolated from the combustion side of the heater to prevent their being damaged by flame, radiant heat or backfire.

5.4 *Combustion chamber and heat exchanger assembly.*

5.4.1 The combustion chamber and heat exchanger assembly shall be constructed from a corrosion and heat resistant material in accordance with SAE Aeronautical Material Specification AMS 5540, or equivalent.

5.4.2 Means shall be provided to minimize malfunctioning due to lead deposits and to permit disassembly and cleaning of all parts affected by products of combustion.

[1] Copies may be obtained from the Society of Automotive Engineers, 29 West 39th St., New York, N. Y.

5.4.3 The accumulation of lead scale or product of combustion deposits shall not cause functional failure before 500 hours of heater operation.

5.4.4 The heater combustion chamber and heat exchanger assembly shall be so designed that it will not rupture under the most severe explosion conditions that can occur with any possible fuel air mixture as demonstrated by test procedure outlined in section 6.1.6.

5.5 *Exhaust.*

5.5.1 The temperature of the exhaust gases at the point of discharge from the heater shall not exceed 1200° F. at rating. (See section 5.1.)

5.6 *Ignition.*

5.6.1 Ignition may be accomplished by:

5.6.1.1 Electrically heated resistance hot wire.

5.6.1.2 Electric high-voltage spark plug.

5.6.2 Ignition may be sustained during operation of the heater or discontinued if satisfactory combustion is assured.

5.6.3 The igniter shall be capable of functioning over a period of 200 hours without service. See test, section 6.5.5.

5.6.4 In event of ignition delay for an indefinite period, either with or without fuel supply, no hazardous condition shall result.

5.6.5 Heaters which are intended for wing-empennage heating shall ignite within 15 seconds under conditions of paragraph 6.1.2.3 except that the temperature shall not be higher than −20° F.

5.7 *Safety controls.* The following automatic safety controls shall be furnished separately or as part of the heater. These controls shall be independent of and in addition to the normal operating controls.

5.7.1 A control to shut off the heater fuel flow in case combustion air supply is insufficient for safe operation.

5.7.2 A control to prevent the heater from becoming overheated under any condition of ventilating air flow.

5.8 *Lines and fittings.*

5.8.1 All pipe and tubing fittings used shall comply with applicable AN standards.

5.8.2 Other fittings not covered above shall conform to accepted aircraft practice.

5.9 *Electrical equipment.*

5.9.1 All electrical equipment, including wiring, instruments, motors, insulation, shielding, relays, etc., shall conform to acceptable aircraft practice.

6. *Test requirements and methods.*

6.1 *Performance tests.* Tests shall be conducted to establish the following:

6.1.1 Ignition characteristic curve, plotting altitude as the ordinate and combustion air pressure differential as the abscissa such that the area under the curve represents the region of reliable starting and burning at −65° F. Include information on temperature of fuel and combustion air supplied to heater. The service ceiling of the heater and its accompanying ignition devices shall be defined as the peak of the ignition characteristic curve. A time record shall be kept on each test start.

6.1.2. Heat output, ventilating air pressure drop, combustion air pressure drop, exhaust temperature, ventilating air temperature rise, fuel rate at—

6.1.2.1 Sea level rating. (See section 5.1.)

6.1.2.2 Sea level rating, except with −65° F. inlet ventilating air, combustion air, and fuel temperatures.

6.1.2.3 20,000 feet pressure altitude with:

(a) Sea level rated weight of ventilating air at −65° F, inlet temperature.

(b) Combustion air at −65° F, inlet temperature, and combustion air pressure differential midway between 20,000 feet altitude ignition limits determined in 6.1.1.

(c) Sea level rated values of voltage and fuel pressure.

(d) Fuel at −65° F, inlet temperature.

NOTE: Temperature measurements for output shall be made in a manner which will provide a representative average temperature of the discharge air. Temperature sensing elements used in test shall be protected against effects of radiation from the heater.

6.1.3 Maximum starting and maximum running amperages required with normal voltage for operation of the heater and accompanying devices at sea level.

6.1.4 Voltage range within which the heater and accompanying devices will operate at sea level and service ceiling.

6.1.5 Collapsing pressure of the combustion chamber and heat exchanger assembly.

6.1.5.1 The heater shall be set up with an adjustable restriction on the combustion air inlet, and a source of vacuum connected to the exhaust outlet. The ventilating air shall discharge freely to atmosphere (sea level). A static pressure tap shall be provided in the exhaust pipe within 12" of the connection to the heater.

6.1.5.2 For a non-pressurized cabin heater or a wing-empennage heater, the heater shall be operated at sea level rating, except that the exhaust outlet pressure is to be maintained at a value which is at least 4 psi below the ventilating air outlet pressure. After operating the heater for at least one hour at these conditions, there must be no permanent distortion of any part of the heater, unless it can be demonstrated that such distortion does not affect the performance or life of the heater.

6.1.5.3 For pressurized cabin heaters, the test shall be the same as 6.1.5.2 except that the exhaust outlet pressure shall be maintained at a value which is at least 10 psi below the ventilating air outlet pressure.

6.1.6 *Combustion chamber burst pressure.* The following design test shall demonstrate compliance with section 5.4.4.

6.1.6.1 With the combustion chamber and heat exchanger assembly at room temperature, introduce a gaseous fuel air mixture in a ratio of from .085 to .095. Purge the combustion chamber and heat exchanger assembly with this mixture to the extent of at least ten times the volume of the combustion chamber and heat exchanger assembly. Ignite the mixture with the heater igniter. Repeat procedure to complete 50 explosions. The heater shall then meet the leakage requirements of section 6.5.4.2.

6.1.7 Radio interference noise levels. See test, section 6.4.

6.1.8 Effect of vibration of heater and accompanying devices. See test, section 6.3.

6.1.9 Minimum life and service requirements of heater and accompanying devices. See test, section 6.5.

6.2 *Test report.* The manufacturer shall furnish a report, on request, covering tests. This report shall include an introduction, a summary, a description of apparatus, instrumentation, and tests, the results, a discussion, and conclusions.

6.3 *Vibration test.* The heater and auxiliary equipment shall be capable of withstanding and satisfactorily operating when subjected to a steady vibration over a range of frequencies from 600 to 2,700 cycles per minute with a total excursion of 1/16", and from 2,700 to 3,200 cycles per minute with an acceleration not exceeding 6 G's. Unless otherwise specified in detail specifications, the equipment shall be mounted on the vibrating apparatus with the longitudinal axis of the heater in a plane parallel to the vibrating surface of the apparatus and normal to the direction of vibration.

6.3.1 The heater shall be vibrated over a range of from 600 to 2,700 cycles per minute with a total excursion of 1/16". The frequencies at which resonance occurs, if any, shall be observed and noted.

6.3.2 The heater will be vibrated over a range of from 2,700 to 3,200 cycles per minute with an acceleration of not less than 5 G's and not more than 6 G's. The frequencies at which resonance occurs, if any, shall be observed and noted.

6.3.3 If resonance is observed under the test of either 6.3.1 or 6.3.2, a vibration test shall be conducted for fifteen hours at the frequency showing the maximum resonance.

6.3.4 If no resonance is observed under the tests of 6.3.1 or 6.3.2, a vibration test shall be conducted for 15 hours at 2,700 cycles per minute with 1/16" total excursion.

6.3.5 At the conclusion of the vibration test there shall be no evidence of structural failure and the heater and accompanying devices shall operate satisfactorily.

6.4 *Radio interference test.*

6.4.1 The heater shall be set up with a sleeve of bare metal ductwork having the same diameter as the heater casing connected at each end of the casing. The length of each piece of ductwork shall be not less than five diameters and shall be connected to the heater with a clamp of the type normally used in an installation.

6.4.2 In the same manner as 6.4.1, connect ductwork or tubing to the combustion air inlet and to the exhaust outlet with respective dimensions determined by diameters of the combustion air inlet and exhaust outlet fittings.

6.4.3 If the ignition voltage transformer is not part of the heater, mount in external to the heater and connect the high voltage terminal to the spark plug by means of the high voltage ignition lead assembly.

6.4.4 With the ignition system operating, check the complete assembly including heater, high voltage device, and high voltage ignition lead assembly using the recommended procedure of specification JAN-I-225 dated June 14, 1945, and Radio Interference Noise Limit Specification AAF-32466-A dated October 17, 1945.

6.5 *Life tests.* Life tests may be conducted in such manner as to qualify the heater and accompanying devices for cabin heating, wing-empennage anti-icing, or both. For cabin heating only, the duration of the test shall be at least 850 hours "on" time. For wing-empennage anti-icing only, the duration of the test shall be at least 500 hours "on" time. For qualification of the heater and accompanying devices under both cabin heating and wing-empennage classifications, the duration of the test may be 850 hours heater "on" time providing at least 500 hours "on" time is performed at wing-empennage conditions.

6.5.1 *General conditions.* The general conditions applying to both cabin and wing-empennage heater life tests shall be as follows:

6.5.1.1 Tests shall be performed at sea level rated fuel pressure and sea level rated combustion air rate.

6.5.1.2 Inlet air temperature shall not exceed 125° F.

6.5.1.3 Approximately 50% of the life test shall be with "continuous" operation, and the remainder of the test with "rapid cycling" operation.

6.5.1.3.1 During "continuous" operation, the ventilating air rate shall be adjusted as required to give the specified temperature rise under steady conditions. At least once, and not more than twice, during each two hours of operating time, the fur and ignition system shall be shut off and the heater permitted to cool for at least 10 minutes with continuous ventilating air and combustion air flow. In calculating total "on" time for the heater, the 10-minute cooling periods shall not be included.

6.5.1.3.2 During "rapid cycling" operation, a thermostatic switch in the ventilating air outlet stream shall cycle the fuel on and off the maintain a specified outlet air temperature. The ventilating air rate shall be adjusted so that the average heat output (assuming that the setting of the cycling switch represents the average outlet air temperature) is between 60 and 75% of the rated output. At least once, and not more than twice during each 2 hours of operating time, the fuel and ignition system shall be shut off and the heater permitted to cool for at least 10 minutes with continuous ventilating air and combustion air flow. For cycling operation "on" time is defined as the total elapsed time during which the rapid cycling switch controls the heater operation; it does not include the 10-minute cooling periods.

6.5.2 *Cabin heater life tests.* The cabin heater life tests shall be divided into four periods, as follows:

6.5.2.1 *First period—250 hours.* Continuous operation, with the ventilating air rate adjusted to maintain a temperature rise of at least 200° F. and an outlet air temperature of at least 250° F.

6.5.2.2 *Second period—250 hours.* Rapid cycling operation, with the cycling switch set to control at 250 ± 10° F. outlet air temperature.

6.5.2.3 *Third period—175 hours.* Same conditions as first period.

6.5.2.4 *Fourth period—175 hours.* Same conditions as second period.

6.5.3 *Wing-empennage anti-icing heater life tests.* Wing-empennage anti-icing heater life tests shall be divided into two periods, as follows:

6.5.3.1 *First period—250 hours.* Continuous operation, with the ventilating air rate adjusted to maintain a temperature rise of at least 300° F. and an outlet air temperature of at least 350° F.

6.5.3.2 *Second period—250 hours.* Rapid cycling operation, with the cycling switch set to control at 350 ± 10° F. outlet air temperature.

6.5.4 *Performance after tests.* At the end of the life and vibration tests the heater shall meet the following requirements:

6.5.4.1 *Carbon monoxide contamination.* At rating conditions, and with the burner operating, carbon monoxide concentration in the heated ventilating air stream shall not exceed one part in 20,000 or 0.005 of 1%. This test shall be run with the heater exhaust discharging to atmosphere. The ventilating air samples shall be taken from an unrestricted duct fastened to the heater ventilating air outlet. The duct shall be the same diameter as the heater casing and at least 5 diameters in length. Use carbon monoxide detector assembly AAF No. 46B1790 or Navy Stock No. R-83-BUA-9258, or equivalent.

6.5.4.2 *Leakage.* With an air pressure of 8 psig inside the combustion chamber and heat exchanger assembly, leakage shall not exceed 9 lbs/hr. (sea level and 59° F). There shall be no leaks which could allow liquid fuel to enter the ventilating air stream in event of ignition failure, when the heater is mounted in any normal position, with drains open.

6.5.4.3 For pressurized cabin heaters, with pressurized jacket, air leakage through the ventilating air shroud or casing shall not exceed 10 lbs/hr. at sea level and room temperature when air pressure of 16 psig is applied to the ventilating air passages.

6.5.4.4 When heater is to be used for wing-empennage anti-icing, the output shall be not less than 90% of the original rating after the life test. If the heater is to be used for cabin heating, the manufacturer shall record in the test report the heater output at the end of the life test.

6.5.5. *Igniter.* Whenever it becomes necessary due to ignition failure during the life test, the igniter may be cleaned, adjusted, or replaced. However, the igniter shall not require servicing or replacement more than twice during the life test of a wing-empennage heater or more than four times during the life test of a cabin heater.

6.5.6 *Fuel system.*

6.5.6.1 Whenever necessary due to stoppage or failure, the fuel orifice or nozzle may be cleaned or replaced. Such servicing shall not be required more than once during a wing-empennage heater life test or twice during a cabin heater life test.

6.5.6.2 The fuel shut off valve may be cleaned once during a wing-empennage heater life test and twice during a cabin heater life test. It shall not be cleaned, serviced, or replaced due to failure to close during the life test. At the end of the life test the valve leakage in the closed position with rated fuel pressure shall not exceed two cubic centimeters of fuel in ten minutes.

6.5.6.3 The fuel filter may be cleaned or the filter element replaced but the filter body shall not be replaced during the life test. At the end of the life test there shall be no leakage through the case or body.

6.5.7 *Safety controls.*

6.5.7.1 The device used to prevent the heater from becoming overheated shall not be serviced or replaced during the life test due to failure to shut off the heater. At the beginning of the life test and at the end of each test period (section 6.5.2 or 6.5.3), any cycling or intermediate controls shall be bypassed and the ventilating air rate gradually reduced over a period of 15 minutes to permit operation of this device. Operation shall be within ±25 F. of the value obtained at the beginning of the life test.

6.5.7.2 The device to prevent fuel flow when combustion air is insufficient for safe operation shall be sensitive to heater combustion air pressure differential or to combustion air pressure. The device may be an air actuated electrical switch designed for use with an electrical fuel shut off valve, or an air actuated mechanical valve designed to control the flow of fuel.

6.5.7.2.1 If an air actuated electrical switch is used, it shall be checked as follows at the end of each test period (section 6.5.2 or 6.5.3) with the heater in operation:

6.5.7.2.1.1 Reduce the combustion air differential pressure or combustion air pressure gradually (approximately 30 seconds) from normal rating to a point where the switch closes the electrical fuel shut off valve. The combustion air differential pressure or combustion air pressure at which the fuel shut off valve closes shall not be less than the minimum value required for safe heater operation. At the end of 15 minutes "fuel off" time, the combustion air differential pressure or combustion air pressure, as applicable, shall be gradually increased at the same rate and the switch shall open the electrical fuel shut off valve at or above the rated combustion air pressure differential.

6.5.7.2.2 If an air actuated mechanical fuel valve is used it shall be checked as follows at the end of each test period (sections 6.5.2 or 6.5.3):

6.5.7.2.2.1 With the heater operating and with the fuel shut off valve "open", the combustion air differential pressure shall be reduced gradually (approximately 30 seconds) from normal rating to value required for safe heater operation. Leakage through the air actuated mechanical fuel valve shall then be measured and shall not exceed two cubic centimeters in ten minutes. At he end of 15 minutes "fuel off" time, the combustion air differential pressure shall be gradually increased at the same rate and the valve shall permit rated fuel flow when the rated combustion air pressure differential is reached.

6.5.7.3 *Ignition system.*

6.5.7.3.1 If necessary, the high voltage device may be serviced or parts replaced once during the life test.

6.5.7.3.2 If necessary, the high voltage ignition lead assembly or equivalent may be serviced or replaced once during the life test.

6.5.7.4 Unless otherwise specified, items 6.5.7.1, 6.5.7.2, 6.5.7.2.1, 6.5.7.2.2, 6.5.7.3, and 6.5.7.3.2, if furnished separately, not as part of the heater, need not be tested more than once providing no changes are made in their design, construction, or adjustment.

6.5.7.5. In case of life test failure of one or more of the devices in items 6.5.7.1, 6.5.7.2, 6.5.7.2.1, 6.5.7.2.2, 6.5.7.3, and 6.5.7.3.2, the test may be continued to qualify the heater or devices that have not failed. A separate life test shall apply only to the failed device if necessary to establish reliability.

7. *Desirable features* (Not Mandatory).

7.1 *Operation.*

7.1.1 The operation of the heater and accompanying devices should require a minimum of moving parts.

7.1.2 The heater should start operation within five seconds at −65° F. at sea level and at its service ceiling, and should reach its maximum output within three minutes after being started.

7.1.3 The heater should be designed in such a manner as to preclude violent explosions on being started.

7.1.4 The heater should be designed in such a manner and made from such materials as to withstand deteriorating effects of high humidity, condensation, fungus, and abrasive particles in the air.

7.1.5 The heater and its accompanying devices should not be adversely affected if subjected to ambient temperatures up to 160° F. for indefinite periods.

7.1.6 The heater should be designed to give low air pressure drop at high altitudes.

7.1.7 Where necessary, additional devices such as the following, may be provided to improve heater operation.

7.1.7.1 Air pressure regulator.
7.1.7.2 Fuel pressure regulator.
7.1.7.3 Combustion air blower.
7.1.7.4 Ventilating air blower.
7.1.7.5 Fuel air ratio control.
7.1.7.6 Thermal cycling switch.
7.1.7.7 Cabin heat controls.

7.2 *Igniter.* The igniter should be accessible for quick replacement or servicing.

7.3 *Fuel nozzle.* The fuel nozzle should be accessible for quick replacement or servicing.

(2) *Application.* (i) Combustion heaters complying with the specifications appearing in this order are hereby approved for all aircraft. Heaters already approved by the Administrator may continue to be installed in aircraft:

(*a*) For which an application for original type certificate is made prior to the effective date of this order.

(*b*) The prototype of which is flown within one year after the effective date of this order, and

(*c*) The prototype of which is not flown within one year after the effective date of this order if due to causes beyond the applicant's control.

(ii) If an alteration involving a change in type or model of heater is made within nine months after the effective date of this order, previously approved types of heaters may be installed. However, in any such change made after the nine-month period, new types of heaters installed shall meet the specifications contained herein.

(c) *Specific instructions*—(1) *Marking.* In addition to the identification information required in the referenced specification, each heater shall be permanently marked with the Technical Standard Order designation, CAA-TSO-C20, to identify the heater as meeting the requirements of this order in accordance with the manufacturers' statement of conformance outlined in subparagraph (5) of this paragraph. This identification will be accepted by the Civil Aeronautics Administration as evidence that the established minimum safety requirements for combustion heaters have been met.

(2) *Data requirements.* Ten copies of the following technical information shall be submitted by the manufacturer of the heater with his Statement of Con-

formance to the Civil Aeronautics Administration, Aircraft Service, Attn: A-298, Washington 25, D. C.:

(i) Rated combustion air flow rates (or pressure drop) including minimum safe rate and variation with altitude.

(ii) Rated ventilating air flow rates (or pressure drop) including minimum safe rate and variation with altitude.

(iii) Ignition characteristics curve established in accordance with Section 6.1.1 of Specification AS143B.

(iv) Minimum operating voltage used for subdivision (iii) of this subparagraph.

(v) Maximum operating altitude.

(vi) Operating fuel pressure.

(vii) Installation diagram showing installation of safety devices necessary to achieve compliance with Sections 4.2, 5.7 and 6.5.7 through 6.5.7.2.2.1 of Specification AS143B.

(viii) Recommended electrical arrangement and any necessary limitations and pressure or temperature settings which are considered essential to proper and safe installation and operation.

(3) *Effective date.* After June 15, 1949, specifications contained in this order will constitute the basis for Civil Aeronautics Administration approval of combustion heaters for use in certificated aircraft.

(4) *Deviations.* Requests for deviation from, or waiver of, the requirements of this order, which affect the basic airworthiness of the component, should be submitted for approval by the Chief, Aircraft Service, Office of Aviation Safety, Civil Aeronautics Administration. These requests should be addressed to the nearest Regional Office of the Civil Aeronautics Administration, Attn: Superintendent, Aircraft Branch.

(5) *Conformance.* (i) The manufacturer shall furnish to the Civil Aeronautics Administration, Aircraft Service, Attn: A-298, Washington 25, D. C., a written statement of conformance signed by a responsible official of his company, setting forth that the heater to be produced by him meets the minimum safety requirements established in this order. This statement shall indicate whether the heater meets the standards for cabin or wing-empennage heaters as prescribed in SAE Aeronautical Standard AS-143B and whether it has met the standards of this specification pertinent to pressurized systems. Immediately thereafter distribution of the heaters conforming with the terms of this order may be started and continued.

(ii) The prescribed identification on the heater does not relieve the aircraft manufacturer or owner of responsibility for the proper application of the heater in his aircraft, nor waive any of the requirements concerning type certification of the aircraft in accordance with existing Civil Air Regulations.

(iii) If complaints of nonconformance with the requirements of this order are brought to the attention of the Civil Aeronautics Administration, and investigation indicates that such complaints are justified, the Administrator will take appropriate action to restrict the use of the product involved.

(iv) Copies of this Technical Standard Order and other Technical Standard Orders may be obtained from the Civil Aeronautics Administration, Aviation Information Staff, Washington 25, D. C.

[Supp. 7, 14 F. R. 3308]

§ 4b.447 *Cabin interiors.* All compartments occupied or used by the crew or passengers shall comply with the following provisions:

(a) Materials shall in no case be less than flash-resistant.

(b) The wall and ceiling linings, the covering of all upholstering, floors, and furnishings shall be flame-resistant.

(c) Compartments where smoking is to be permitted shall be equipped with ash trays of the self-contained type which are completely removable. All other compartments shall be placarded against smoking.

(d) All receptacles for used towels, papers, and waste shall be of fire-resistant material, and shall incorporate covers or other provisions for containing possible fires started in the receptacles.

[Amdt. 04-1, 11 F. R. 11351]

§ 4b.447-1 *Fire-resistant aircraft material (CAA rules which apply to § 4b.447).* See §§ 4b.448-3.

[13 F. R. 7728]

§ 4b.448 *Cargo and baggage compartments*—(a) *General.* Each cargo and baggage compartment shall be designed for the placarded maximum weight of contents and critical load distributions at the appropriate maximum load factors corresponding to all specified flight and ground load conditions, excluding the emergency landing conditions of §§ 4b.291 and 4b.292. Provisions shall be made to prevent the contents of such compartments from becoming a hazard by shifting under these loads. The provisions also shall be adequate to protect the passengers and crew from injury by the contents of any compartment when the ultimate inertia force acting forward is 6 *g*.

(b) *Fire precautions.* (1) Each compartment shall be designed so that, when used for the purpose of storing cargo or baggage, it shall comply with all the requirements prescribed for cargo or baggage compartments. It shall include no controls, wiring, lines, equipment, or accessories, the damage or failure of which would affect the safe operation of the airplane, unless such item is adequately shielded, isolated, or otherwise protected so that it cannot be damaged by movement of cargo in the compartment, and so that any breakage or failure of such item would not create a fire hazard in the compartment. Provisions shall be made to prevent cargo or baggage from interfering with the functioning of the fire-protective features of the compartment. All materials used in the construction of cargo or baggage compartments, including tie-down equipment, shall be flame-resistant or better.

(2) In addition, all cargo and baggage compartments shall include provisions for safeguarding against fires according to the following classifications:

(i) Cargo and baggage compartments shall be classified in the A category, if presence of a possible fire therein can be readily discernible to a member of the crew while at his station, and if all parts of the compartment are easily accessible in flight. A hand fire extinguisher shall be available for such compartment.

(ii) Cargo and baggage compartments shall be classified in the B category, if sufficient access is provided while in flight to enable a member of the crew to move by hand all contents and to reach effectively all parts of the compartment with a hand fire extinguisher. Furthermore, the design of the compartment shall be such that, when the access provisions are being used, no hazardous quantity of smoke, flames, or extinguishing agent will enter any compartment occupied by the crew or passengers. Each compartment in this category shall be equipped with a separate system of an approved type smoke detector or fire detector other than heat detector to give warning at the pilot or flight engineer station. Hand fire extinguishers shall be readily available for use in all compartments of this category. Compartments in this category shall be completely lined with fire-resistant material, except that additional service lining of flame-resistant material may be employed.

(iii) Cargo and baggage compartments shall be classified in the C category if they do not conform with the requirements for the A or B categories. Each compartment of the C category shall be equipped with: (*a*) A separate system of an approved type smoke detector or fire detector other than heat detector to give warning at the pilot or flight engineer station, and (*b*) an approved built-in fire extinguishing system controlled from the pilot or flight engineer station. Means shall be provided to exclude hazardous quantities of smoke, flames, or extinguishing agent from entering into any compartment occupied by the crew or passengers. Ventilation and drafts shall be further controlled within each such cargo or baggage compartment to the extent that the extinguishing agent provided can control any fire which may start within the compartment. All cargo and baggage compartments of this category shall be completely lined with fire-resistant material, except that additional service lining of flame-resistant material may be employed.

(c) *Proof of compliance.* Compliance with those provisions of § 4b.448 (b) which refer to the compartment accessibility, the entry of hazardous quantities of smoke or extinguishing agent into compartments occupied by the crew or passengers, and the dissipation of the extinguishing agent in category C compartments shall be demonstrated by tests in flight. It shall also be demonstrated during these tests that no inadvertent operation of smoke or fire detectors in adjacent or other compartments within the airplane would occur as a result of fire contained in any one compartment, either during or after extinguishment, unless the extinguishing system floods such compartments simultaneously.

[Amdt. 04-1, 11 F. R. 11351]

§ 4b.448-1 *Technical Standard Order TSO-C1a: "Smoke Detectors" (CAA rules which apply to § 4b.448 (b)*—(a) *Intro-*

duction. (1) Smoke detectors are in the class of aircraft components which the Administrator of Civil Aeronautics is authorized to approve in accordance with Parts 4a and 4b of this subchapter.

(2) This Technical Standard Order is intended to serve as a criterion by which the product manufacturer can obtain Civil Aeronautics Administration approval of his smoke detector.

(3) In the establishment of this Technical Standard Order, consideration has been given to existing Government and industry standards for smoke detectors for the purpose of adopting the performance requirements of one of the recognized aeronautical standards as the minimum safety requirements for smoke detectors which are intended for use in civil aircraft. The specification of the Society of Automotive Engineers for smoke detectors contains such requirements.

(b) *Directive*.

(1) *Provision*. Pursuant to §§ 4a.31, 4a.301, 4b.41, and 4b.448 of this subchapter, which authorize the Administrator to approve aircraft equipment, the performance requirements for smoke detectors as set forth in SAE Specification AS–400, Smoke Detectors, dated July 1, 1947,[1] stated below, with the exceptions hereinafter noted, are established as the minimum safety requirements for smoke detectors which are intended for use in civil aircraft:

1. *Purpose*. To specify minimum requirements for smoke detection instruments for use in aircraft, the operation of which may subject the instrument to environmental conditions specified in section 3.4.

2. *Scope*. This specification covers two basic types as follows:

Type I. Carbon monoxide.

Type II. Photoelectric cell.

3. *General requirements*.

3.1. *Material and workmanship*.

3.1.1. *Material*. Materials shall be of a quality which experience or tests have demonstrated to be suitable and dependable for use in aircraft instruments.

3.1.2. *Workmanship*. Workmanship shall be consistent with high-grade aircraft instrument manufacturing practice.

3.2. *Radio interference*. The instrument shall not be the source of objectionable interference, under operating conditions at any frequencies used on aircraft, either by radiation or feed-back, in radio sets installed in the same aircraft as the instrument.

3.3. *Identification*. The following information shall be legibly and permanently marked on the instrument or attached thereto:

(a) Name of instrument (smoke detector).

(b) SAE Spec. AS–400.

(c) Rating (electrical, vacuum, etc.).

(d) Manufacturer's part number.

(e) Manufacturer's serial number or date of manufacture.

(f) Manufacturer's name and/or trademark.

3.4. *Environmental conditions*. The following conditions have been established as design criteria only. Tests shall be conducted as specified in sections 5, 6, and 7.

3.4.1. *Temperature*. When mounted in accordance with the instrument manufacturer's instructions, the instrument shall function over the range of ambient temperature of −55° C. to 60° C. and shall not be adversely affected by exposure to temperatures in the range −65° C. and to 70° C.

3.4.2. *Humidity*. The instrument shall function and not be adversely affected when exposed to a relative humidity of up to and including 95% at a temperature of approximately 32° C.

3.4.3. *Altitude*. The instrument shall function and not be adversely affected when subjected to a pressure and temperature range equivalent to −1,000 feet to +40,000 feet standard altitude.

3.4.4. *Vibration*. When mounted in accordance with the instrument manufacturer's instructions, the units shall function and shall not be adversely affected when subjected to the following vibrations:

Type of instrument mounting	Cycles per minute [1]	Amplitude [1]	Max. acceleration
		Inch	
Shock mounted panel instruments	500-3000	0.005	0.8 g
Unshock mounted panel instruments	500-3000	.010	1.3 g
Airframe structure mounted instruments	500-3000	.030	3.8 g

[1] It is understood that the unit shall withstand vibrations at higher frequencies, but the acceleration values need not exceed those shown above.

When specified by the purchaser for use in rotary wing aircraft, the frequency range shall be 150-3000 cycles per minute.

4. *Detail requirements*.

4.1. *Design*.

4.1.1. The instrument shall consist of a means for:

Type I: Testing air for contamination with gaseous products of combustion. It shall include an alarm circuit or control circuit which will indicate the presence of contamination when it reaches a concentration of not more than 0.010% of carbon monoxide by volume.

Type II: Testing air for contamination with smoke or gas of all colors or particle sizes. It shall include an alarm circuit or control circuit which will indicate the presence of contamination which reduces the light transmission to not less than 90% of that of clear air. Percentage of transmission is defined as the light falling on a photoelectric cell through a one foot distance as compared to the light transmitted in clear air.

4.1.2. A means shall be incorporated in the design to admit the air sample to the sensitive element of the instrument in a positive manner.

4.2. *Indicating method*. The instrument shall be capable of actuating both visual and aural alarm indicators.

4.3. *Reliability*. False signals in the instrument shall not result from variations in voltage (+25% and −100% of the rated), flight altitude, accelerations encountered in flight or landing, and from normal amounts of dust they may accumulate within the instrument under normal flight operation.

4.4. *Integrity test provision*. The instrument shall be provided with a means for being tested in flight. The test shall cause operation of the alarm circuit or control circuit by initiating the sequency of actions through a disturbance in the instrument.

4.5. *Sampling characteristics*. When an instrument installation is designed to divert the air samples from more than one sampling station, it shall cycle at a rate not to exceed 30 seconds per sampling station, in which case, flow of air through all the sampling conduits shall be maintained continuously. In addition, when a smoke alarm is indicated, an alarm shall be actuated to indicate the location in which the smoke or gas is being generated and to continue to indicate the alarm until the condition is eliminated. It shall begin cycling in a normal manner within 30 seconds after releasing the alarm signal.

5. *Test conditions*.

5.1. *Atmospheric conditions*. Unless otherwise specified, all tests required by this specification shall be made at an atmospheric pressure of approximately 29.92 inches of mercury and at an ambient temperature of 22° C. When tests are made with the atmospheric pressure or the temperature substantially different from these values, allowance shall be made for the variations from the specified conditions.

5.2. *Vibration (to minimize friction)*. Unless otherwise specified, all tests for performance may be made with the instrument subjected to a vibration of 0.002 to 0.005 inch amplitude at a frequency of 1,500 to 2,000 cycles per minute. The term amplitude as used herein indicates the total displacement from positive maximum to negative maximum.

5.3. *Vibration stand*. A vibration stand shall be used which will vibrate at any desired frequency between 500 and 3,000 cycles per minute and shall subject the instrument to vibration such that a point on the instrument will describe, in a plane inclined 45 degrees to the horizontal plane, a circle, the diameter of which is equal to the amplitude specified herein.

5.4. *Test position*. Unless otherwise specified, the instrument shall be mounted and tested in its normal operation position.

5.5. *Air sample*. Unless otherwise specified, air samples shall be as follows:

(1) Air containing 0.01% plus or minus 0.005% carbon monoxide, or

(2) Air containing smoke or gas having a light transmission value of 85% to 92% of that of clear air.

5.6. *Power conditions*. Unless otherwise specified all tests for performance shall be conducted at the power rating recommended by the manufacturer.

6. *Individual performance requirements*. All instruments, or components of such, shall be subjected to whatever tests the manufacturer deems necessary to demonstrate specific compliance with this specification including the following requirements where applicable.

6.1. *Response time*. The instrument shall be tested, so that, when an air sample per section 5.5 is introduced into the instrument under normal room temperature and atmospheric pressure conditions the alarm circuit or control circuit shall be energized within a maximum of 30 seconds.

6.2. *Dielectric*. The insulation shall be subjected to a dielectric test with an R. M. S. voltage at a commercial frequency applied for a period of 5 seconds equivalent to 5 times normal circuit operating voltage, except where circuits include components for which such a test would not be appropriate the test voltage shall be 1.25 times the normal circuit operating voltage. The insulation response shall not be less than 20 megohms at that voltage.

7. *Qualification tests*. As many instruments as deemed necessary to demonstrate that all instruments will comply with the requirements of this section shall be tested in accordance with the manufacturer's recommendations. The tests of each instrument shall be conducted consecutively and after the tests have been initiated, no further adjustments of the instrument shall be permitted. For those instruments which employ a cycling device for testing a multiplicity of locations with one instrument, these tests shall be conducted on the basis of a single sample station. During these tests no false alarm shall result.

7.1. *Stability*. The instrument shall be operated continuously for 24 hours at room temperature. At the end of the first and twenty-fourth hour of operation a sample of air, per section 5.5, shall be introduced into the instrument and the time required for operation of the alarm circuit or control circuit shall not exceed 30 seconds.

7.2. *Suction variation*. The instrument shall be operated continuously by varying the

[1] Copies may be obtained from the Society of Automotive Engineers, 29 West 39th St., New York, N. Y.

suction from 25% below to 25% above the rated. At each of these values a sample of air, per section 5.5, shall be introduced into the instrument and the time required for operation of the alarm circuit or control circuit shall not exceed 30 seconds.

7.3. *Voltage variation*. The instrument shall be operated with the voltage varying from 110% to 85% of the rated voltage. The instrument shall then be tested with an air sample, per section 5.5, and the response time shall not exceed 30 seconds.

7.4. *High temperature*. The instrument shall be exposed to a temperature of 70° C. for a period of 6 hours after which it shall be tested with air at 60° C. for a period of 30 minutes without giving a false alarm. The instrument shall then be tested with an air sample, per section 5.5, and the response time shall not exceed 30 seconds.

7.5. *Low temperature*. The instrument shall be exposed to a temperature of −65° C. for a period of 24 hours, after which it shall be raised to a temperature of −55° C. for a period of 6 hours. After operating for 30 minutes at a temperature −55° C., without giving a false alarm, the response time to the air sample in section 5.5 shall not exceed 30 seconds.

7.6. *Humidity*. The instrument shall be subjected to an atmosphere 32° C. with a relative humidity of 95%, with the air sample being taken from the same atmosphere. After operating in this manner for 5 hours, an air sample per section 5.5, shall be introduced into the instrument and the time required for operation of the alarm circuit or control circuit shall not exceed 30 seconds.

7.7. *Altitude effect*. The instrument shall be subjected to an altitude pressure equivalent to 40,000 feet. After operating in this manner continuously for five hours the time required for reaction of the alarm circuit or control circuit, on a sample of air per section 5.5, shall not exceed 30 seconds.

7.8. *Vibration*. The instrument shall be mounted on a vibration stand, in its own shock-mounted base, if provided with one, in its normal operating plane. The test shall be conducted with the instrument in normal operation condition. The instrument shall be subjected to vibration with an amplitude between 0.003 and 0.005 inch at frequencies from 500 to 3,000 cycles per minute, in order to determine whether the natural frequency of the instrument does occur in this frequency range.

7.9. *Vibration endurance*. With the instrument mounted on a vibration stand, per section 7.8 and with the instrument in a normal operating condition, it shall be vibrated continuously at a total amplitude of 0.03 inch for a period of 24 hours at the natural frequency, if applicable, as determined in section 7.8, or if not applicable at a frequency of 2,000 cycles per minute. At the completion of this test the instrument shall be examined to determine that no looseness in the mechanism nor damage to any part has resulted from the vibration and also, it shall be subjected to a sample of air introduced into it as per section 5.5 and the response time shall not exceed 30 seconds.

(2) *Exceptions*. Section 4.1.1, *Design*. Second sentence of Type II: "It shall include an alarm circuit or control circuit which will indicate the presence of contamination which reduces the light transmission to not less than 84% nor more than 96% of that of clear air."

Section 5.5, *Air sample*. Subparagraph (2): "Air containing smoke or gas having a light transmission value of 84% to 96% of that of clear air. A bar placed across light path to provide necessary light cutoff which has been calibrated against smoke may be used in place of actual smoke samples."

Section 7.3, *Voltage variation*. "The instrument may be operated with the voltage varying from 110% to 90% of the rated voltage. The response time to an air sample per section 5.5 shall not exceed 30 seconds."

Section 7.4, *High temperature*. "An air temperature of 45° C. is acceptable for the test after six hours of exposure at 70° C. The response time to an air sample per section 5.5 shall not exceed 30 seconds."

Section 7.5, *Low temperature*. "The instrument may be exposed to a temperature of −54° C. for a period of 24 hours after which time it shall be operated for a period of 30 minutes at −54° C. without giving a false alarm. The response time to an air sample per section 5.5 shall not exceed 30 seconds."

(3) *Application*. (i) Smoke detectors complying with the specifications appearing in this order are hereby approved for all aircraft. Smoke detectors already approved by the Administrator may continue to be installed in aircraft:

(*a*) For which an applicatiton for original type certificate is made prior to the effective date of this order,

(*b*) The prototype of which is flown within 1 year after the effective date of this order, and

(*c*) The prototype of which is not flown within 1 year after the effective date of this order if due to causes beyond the applicant's control.

(ii) If a major change is made in the installation within 9 months after the effective date of this order involving a change in type or model of smoke detector, previously approved types of smoke detectors may be installed. However, in any such change made after the 9-month period, new types of smoke detectors installed shall meet the specifications contained herein.

(c) *Specific instructions*.

(1) *Marking*. In addition to the identification information required in the referenced specification, each smoke detector shall be permanently marked with the Technical Standard Order designation "CAA-TSO-C1a" to identify the smoke detector as meeting the requirements of this order in accordance with the manufacturer's statement of conformance outlined below. This identification will be accepted by the Civil Aeronautics Administration as evidence that the established minimum safety requirements for the smoke detector have been met.

(2) *Data requirements*. Ten copies of the following technical information shall be submitted to the Civil Aeronautics Administration, Aircraft and Components Service, Attn: A-298, Washington 25, D. C.:

Installation recommendations prepared by the manufacturer covering the proper location, mounting, test circuits, and related technical information essential to insure proper functioning and maintenance of the unit as installed in the aircraft.

(3) *Effective date*. After June 1, 1948, specifications contained in this Technical Standard Order will constitute the basis for Civil Aeronautics Administration approval of smoke detectors for use in certificated aircraft.

(4) *Deviations*. Requests for deviation from, or waiver of, the requirements of this order, which affect the basic airworthiness of the component, should be submitted for approval by the Director, Aircraft and Components Service, Office of Safety Regulation, Civil Aeronautics Administration. These requests should be addressed to the nearest regional office of the Civil Aeronautics Administration, Attn: Superintendent, Aircraft and Components Branch.

(5) *Conformance*. (i) The manufacturer shall furnish to the CAA (address as noted under "Data requirements" above), a written statement of conformance signed by a responsible official of his company, setting forth that the smoke detector to be produced by him meets the minimum safety requirements established in this order. Immediately thereafter distribution of the smoke detector conforming with the terms of this order may be started and continued.

(ii) The prescribed identification on the smoke detector does not relieve the aircraft manufacturer or owner of responsibility for the proper application of the smoke detector in his aircraft, nor waive any of the requirements concerning type certification of the aircraft in accordance with existing Civil Air Regulations.

(iii) If complaints of nonconformance with the requirements of this order are brought to the attention of the Civil Aeronautics Administration, and investigation indicates that such complaints are justified, the Administrator will take appropriate action to restrict the use of the product involved.

(iv) Copies of this Technical Standard Order and other Technical Standard Orders may be obtained from the Civil Aeronautics Administration, Aviation Information Staff, Washington 25, D. C.

[13 F. R. 3843, 7728]

§ 4b.448-2 *Technical Standard Order TSO-C11: "Fire Detectors" (CAA rules which apply to § 4b.448 (b))*—(a) *Introduction*. (1) Fire detectors are in the class of aircraft components which the Administrator of Civil Aeronautics is authorized to approve in accordance with Parts 4a and 4b of this subchapter.

(2) This Technical Standard Order is intended to serve as a criterion by which the product manufacturer can obtain Civil Aeronautics Administration approval of his fire detector.

(3) In the establishment of this Technical Standard Order, consideration has been given to existing Government and industry standards for fire detectors for the purpose of adopting the performance requirements of one of the recognized aeronautical standards as the minimum safety requirements for fire detectors which are intended for use in civil aircraft. The specification of the Society of Automotive Engineers for fire detectors contains such requirements.

(b) *Directive*.

(1) *Provision*. Pursuant to §§ 4a.31, 4a.301, 4b.41, 4b.448, 4b.671, 4b.672, and 4b.691 of the Civil Air Regulations, which authorize the Administrator to approve

aircraft equipment, the performance requirements for fire detectors as set forth in SAE Specification AS-401, Fire and Heat Detectors, dated December 1, 1947,[1] stated below, with the exceptions hereinafter noted, are hereby established as minimum safety requirements for fire detectors which are intended for use in civil aircraft:

FIRE AND HEAT DETECTORS

1. *Purpose.* To specify minimum requirements for fire and heat detection instruments for use in aircraft, the operation of which may subject the instrument to environmental conditions specified in section 3.4.

2. *Scope.* This specification covers the following basic types of instruments, or combinations thereof, intended for use in protecting aircraft power plant installations, auxiliary power plants, combustion heaters and other installation where fuel, oil or similar fires may occur.

Type I. Rate of temperature rise.

Type II. Flame.

Type III. Fixed temperature.

3. *General requirements.*

3.1. *Materials and workmanship.*

3.1.1. *Materials.* Materials shall be of a quality which experience and/or tests have demonstrated to be suitable and dependable for use in aircraft instruments.

3.1.2. *Workmanship.* Workmanship shall be consistent with high-grade aircraft instrument manufacturing practice.

3.2. *Radio interference.* The instrument shall not be the source of objectionable interference, under operating conditions at any frequencies used on aircraft, either by radiation or feed-back, in radio sets installed in the same aircraft as the instrument.

3.3. *Identification.* The following information shall be legibly and permanently marked on the instrument or attached thereto:

(a) Name of instrument.

(b) SAE Spec. AS-401.

(c) Rating (electrical, vacuum, etc.).

(d) Alarm temperature (sensing element, where applicable).

(e) Manufacturer's part number.

(f) Manufacturer's serial number or date of manufacture.

(g) Manufacturer's name and/or trademark.

3.4. *Environmental conditions.* The following conditions have been established as design criteria only. Tests shall be conducted as specified in sections 5, 6, and 7.

3.4.1. *Temperature.* When mounted in accordance with the manufacturer's recommendations, the unit shall function over the range of ambient temperatures shown in column A below and shall not be adversely affected by exposure to the temperatures shown in column B below:

Instrument location	A	B
Power plant compartments	−20° to 130° C.	−65° to 130° C.
Other areas	−20° to 70° C.	−65° to 70° C.

3.4.2. *Humidity.* The instrument shall function and not be adversely affected by exposure to a relative humidity of up to and including 95% at a temperature of approximately 32° C.

3.4.3. *Altitude.* The instrument shall function and shall not be adversely affected when subjected to a pressure and temperature range equivalent to −1,000 feet to +40,000 feet standard altitude.

[1] Copies may be obtained from the Society of Automotive Engineers, 29 West 39th St., New York, N. Y.

3.4.4. *Vibration.* When mounted in accordance with the instrument manufacturer's instructions, the units shall function and shall not be adversely affected when subjected to the following vibrations at a frequency of 500 to 3,000 cycles per minute. When specified by the purchaser for use in rotary wing aircraft, the frequency range shall be 150 to 3,000 cycles per minute.

Type of instrument mounting	Amplitude	Acceleration
Structurally mounted instruments	*Inch* 0.030	3.8 g
Engine compartment mounted instruments	.20	25 g

It is understood that the instrument shall withstand vibration at higher frequencies, but the acceleration values need not exceed those shown above.

4. *Detail requirements.*

4.1. *Indicating method.* The instrument shall be capable of actuating both visual and aural alarm indicators.

4.2. *Reliability.* False signals in the instrument shall not result from variations in voltage between 0 and 125% of the rated flight altitude, dust and accelerations encountered in flight or landing.

4.3. *Integrity test provisions.* The instrument shall permit testing of the continuity of the associated electrical circuit in flight.

4.4. *Calibration adjustment.* All calibration adjustments in the instrument shall be provided with tamper-proof seals.

5. *Test conditions:*

5.1. *Atmospheric conditions.* Unless otherwise specified, all tests required by this specification shall be conducted at an atmospheric pressure of approximately 29.92 inches of mercury and at an ambient temperature of approximately 22° C. When tests are conducted with the atmospheric pressure or the temperature substantially different from these values, allowance shall be made for the variations from the specified conditions.

5.2. *Vibration (to minimize friction).* Unless otherwise specified, all tests for performance may be made with the instrument subjected to a vibration of 0.002 to 0.005 inches amplitude at a frequency of 1,500 to 2,000 cycles per minute. The term amplitude as used herein indicates the total displacement from positive maximum to negative maximum.

5.3. *Vibration stand.* A vibration stand shall be used which will vibrate at any desired frequency between 500 and 3,000 cycles per minute and shall subject the instrument to vibration such that a point on the instrument will describe, in a plane inclined 45 degrees to the horizontal plane, a circle, the diameter of which is equal to the amplitude specified herein.

5.4. *Test position.* Unless otherwise specified, the instrument shall be mounted and tested in its normal operation position.

5.5. *Power conditions.* Unless otherwise specified, all tests shall be conducted at the power rating recommended by the manufacturer and the instrument shall be in an operating condition.

5.6. *Flame temperature measurement and flame size.* All flame temperatures shall be measured by using an 18 gauge wire thermocouple and the two strands of wire shall be twisted together for a distance of ½ inch from the thermocouple bead. The thermocouple bead shall be at the center of the flame and the two wires leading to the bead shall be parallel and extend radially into the flame. The nature and size of the flame and the method of test shall be specified in Figure 2.

5.7. *Test sample.* Unless otherwise specified, when qualification tests are being conducted on continuous type detectors, at least eight inches of the continuous detecting element shall be subjected to the test conditions as well as at least two typical insulators, supports, or connectors of each basic type used.

6. *Individual performance tests.* A instruments or components of such shall be subjected to whatever tests the manufacturer deems necessary to demonstrate specific compliance with this specification.

6.1. *Response time.* The sensing element shall be tested as specified in section 7.1, or in some equivalent manner which will adequately check the sensitivity and calibration.

6.2. *Dielectric.* The instrument shall be subjected to whichever one of the following dielectric tests is most applicable:

6.2.1. Ungrounded instruments, or grounded instruments prior to connection of internal ground wire, shall be tested by either the method of section 6.2.1.1 or 6.2.1.2.

6.2.1.1. *Insulation resistance.* The insulation resistance measured at 500 volts d-c between all electrical circuits connected together and the metallic case shall not be less than 20 megohms.

6.2.1.2. *Dielectric strength.* The insulation shall withstand without evidence of damage the application of a sinusoidal voltage at a commercial frequency between all electrical circuits connected together and the metallic case, for a period of 5 seconds. The R. M. S. value of the sinusoidal voltage applied shall be either five (5) times the maximum instrument operating voltage, or 500 volts, whichever is the greater.

6.2.2. Instruments operated with a permanent internal ground connection shall be tested as follows:

The insulation shall withstand without evidence of damage the application of a sinusoidal voltage at a commercial frequency between each electric circuit and the metallic case, for a period of 5 seconds. The R. M. S. value of the sinusoidal voltage applied shall be 1.25 times the maximum circuit operating voltage obtainable between two test points.

7. *Qualification tests.* As many instruments as appear necessary to demonstrate that all instruments will comply with the requirements of this section shall be subjected to the following tests where applicable. The tests on each instrument shall be conducted consecutively and after the tests have been initiated, no further adjustments of the instrument shall be permitted. There shall be no false alarms signalled during any of the tests. A response time test per section 7.1 shall be conducted after each qualification test, except sections 7.1.1, 7.2, 7.3, 7.3.1, 7.3.2, 7.3.3 and 7.14. However, except in the case of the response time test following the qualification test of section 7.14, the instrument subjected to the response time test need not be the same instrument or instrument's being subjected to the entire series of qualification tests.

7.1. *Response time.* The sensing element shall be tested in an 815° C. maximum temperature flame as specified in Figure 2. The ambient temperature from which the test is started shall be normal room temperature. However, a higher starting ambient temperature may be used if the sensing element is specified for use only in locations where the ambient temperature will not, under any normal continuous operating conditions, fall below this value. For types of detectors and detector systems whose sensitivity is affected by the number of sensing elements, by the length of the sensing element exposed to flame (for continuous types), or by other factors which may be varied from one system design to another, all response time tests shall be conducted with the least sensitive system configuration to be used. The time of response shall not exceed 5 seconds when the instrument is tested in accordance with this section.

7.1.1. *Repeat response time.* The sensing element(s) of the fire detector system shall be subjected to an 815° C. flame for a period of one minute. It shall then be removed from the flame. Within 5 seconds after the alarm has cleared the sensing element shall again be subjected to the flame. An alarm shall be signalled in five seconds. The units subjected to this test need not be subjected to any other tests.

7.2. *Fixed temperature operation.* (For Type III instruments only.) The detecting element shall be placed in a suitable heating chamber and the temperature shall be raised at the rate of not less than 7° C. per minute, to not less than 80% of the rated temperature setting. The temperature shall be maintained at this value for not less than one hour. The temperature shall then be raised, at a rate of not more than 7° C. per minute, to 10% above the rated temperature setting. An alarm shall be signalled within a tolerance of 10% of the rated temperature setting. The temperature shall then be lowered, at a rate of not more than 7° C. per minute. The alarm indication shall cease before the temperature falls below 90% of the rated setting.

7.3. *False alarm due to rate of temperature rise.* No alarm shall be signalled during these tests except in the case of Type III instruments which may signal an alarm when the temperature reaches a value not less than 90% of the rated setting. For types of detectors and detector systems whose sensitivity is affected by the number of sensing elements, the length of the sensing element exposed to the test temperature (for continuous types), or by other factors which may be varied from one system design to another, the tests of 7.3.1 and 7.3.2 shall be conducted with the most sensitive system configuration to be used.

7.3.1. *False alarm due to local temperature rise.* The sensing element shall be subjected to various combinations of rates of temperature rise and durations of these rates of rise. Except as indicated in section 7.3, no alarm shall be signalled when the element is exposed to any combination of the rates of rise and durations within the shaded area in Figure 3 (a). This test shall be con-

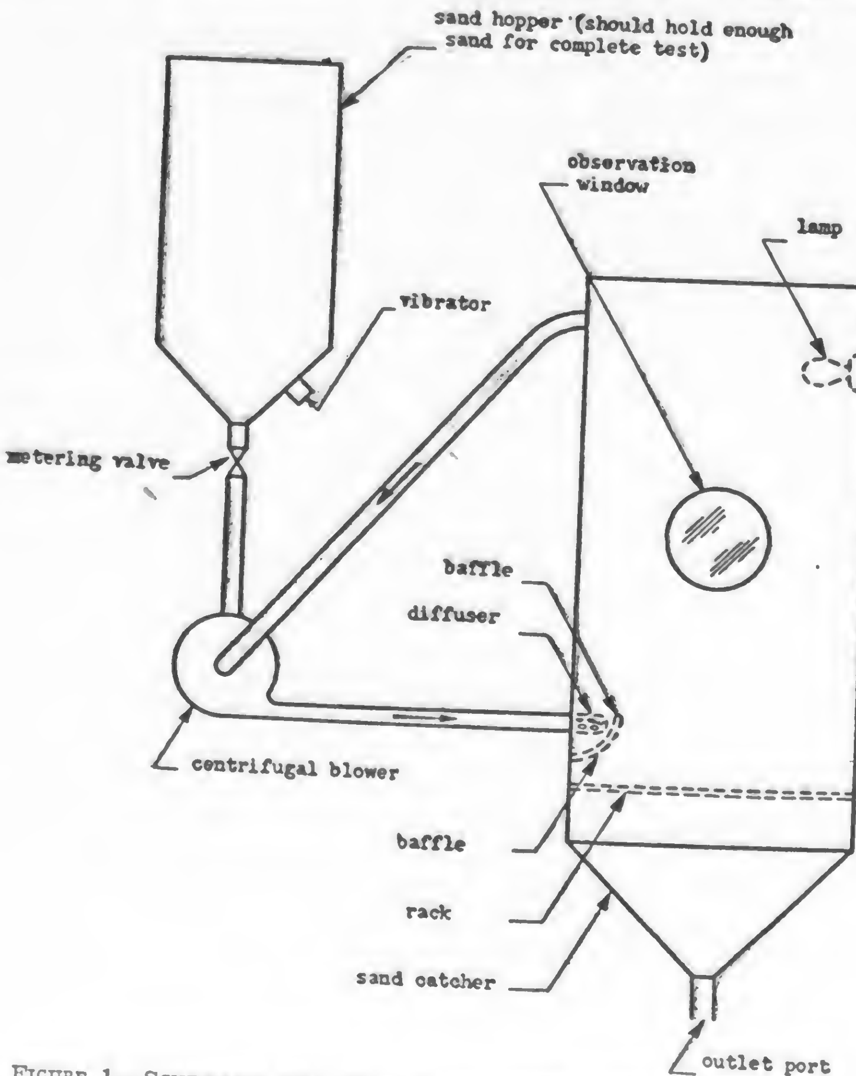


FIGURE 1.—SCHEMATIC SAND TEST ARRANGEMENT (REFERENCE SEC. 7.9).

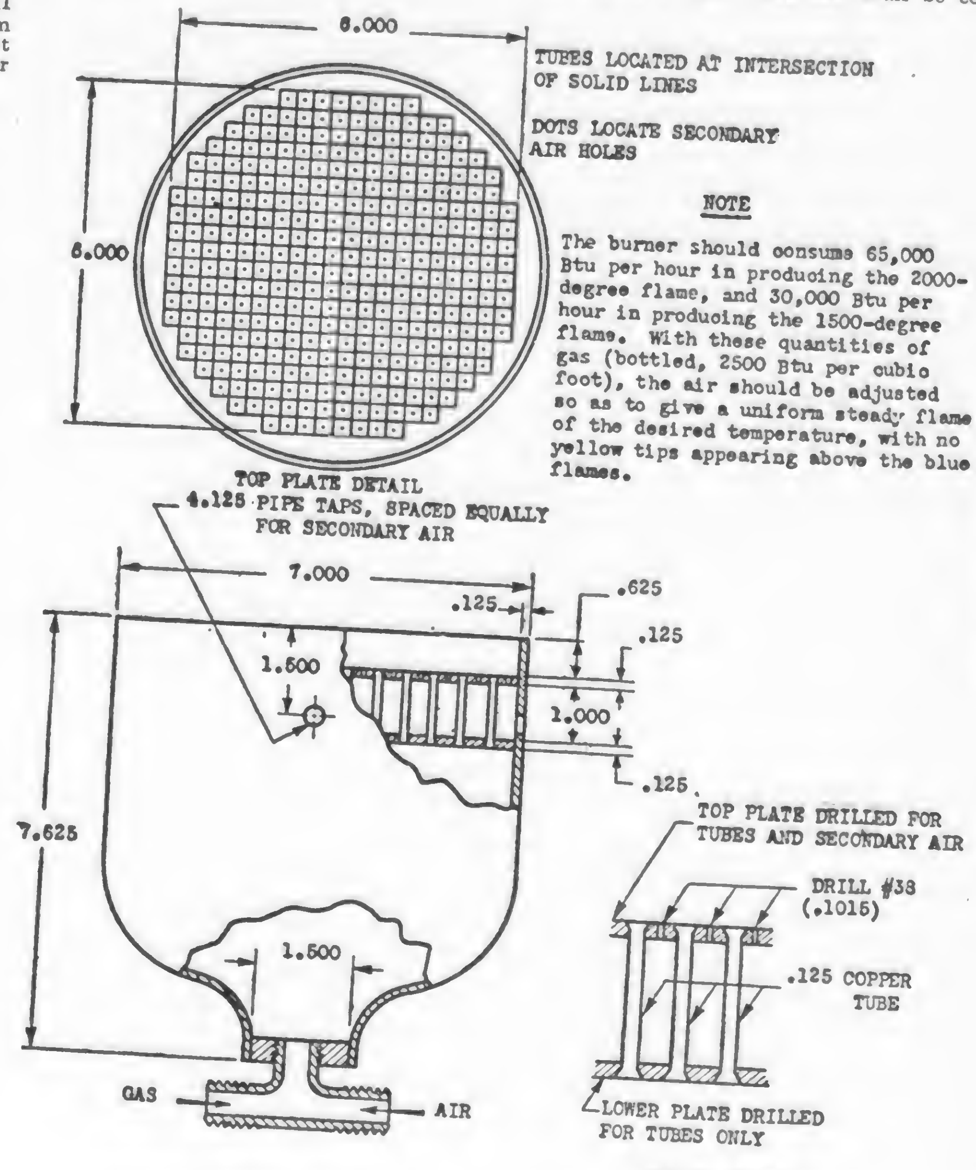


FIGURE 2.—FLAME TEST BURNER (REFERENCE SECS. 5.6, 7.1 AND 7.14).

ducted in a manner simulating conditions due to local overheating.

7.3.2. *False alarm due to general temperature rise.* The test of 7.3.1 shall be repeated except that Figure 3 (b) shall be employed and the test shall be conducted in a manner simulating conditions existing due to a general temperature rise throughout an engine compartment where the sensing element(s) may be located.

7.3.3. *False clearing of alarm due to partial extinguishing of fire.* The system configuration specified in 7.3 shall be subjected to an 815° C. flame for 30 seconds. The flame shall then be removed from all except the portion of the system as specified in 7.1. The alarm shall not clear. After an additional 30 seconds the flame shall be removed entirely and the alarm shall then clear. The units subjected to this test need not be subjected to any other test.

7.4. *Vibration.* The instrument shall be mounted on a vibration stand, in its own shock mounted base, if provided with one, in its normal operating plane. The instrument shall be subjected to vibration with an amplitude between 0.003 and 0.005 inch at frequencies for 500 to 3,000 cycles per minute, in order to determine whether the natural frequency of the instrument occurs in this frequency range.

7.5. *Vibration endurance.* With the instrument mounted on a vibration stand, per section 7.4, it shall be vibrated continuously at a total amplitude as specified in section 3.4.4 for a period of 24 hours at the natural frequency, if applicable, as determined in section 7.4, or if not applicable, at a frequency of 2,000 cycles per minute. No damage shall be evident after this test. In the case of this test, the response time test of 7.1.1 shall be conducted while the instrument is being vibrated. However, the sensing and indicating elements need not be vibrated simultaneously unless it is apparent that simultaneous vibration will be critical.

7.6. *Water spray.* All parts of the instrument which may be installed in exposed portions of the airplane shall be subjected to the following tests:

7.6.1. *Simulated rain.* The components being tested shall be subjected to a spray of water, to simulate rain, for a period of three hours. The detector shall not be dried prior to testing per section 7.1.

7.6.2. *Salt spray.* The components being tested shall be subjected to spray with a 20% sodium chloride solution for a period of fifteen minutes. The components shall then be dried in air at room temperature before they are tested per section 7.1. The components shall not be cleaned before the test of section 7.1 is conducted.

7.7. *Corrosion.* All parts of the instrument which may be installed in exposed portions of the airplane shall be subjected to a finely atomized spray of 20% sodium chloride solution for 200 hours. At the end of this period the parts shall be allowed to dry and may then be cleaned prior to conducting the test per section 7.1.

7.8. *Fuel and oil immersion.* All parts of the instrument which may be located in engine compartments, or other locations where they may be contaminated by fuel or oil, shall be subjected to the following tests:

7.8.1. *Fuel immersion.* The components being tested shall be thoroughly immersed in normally leaded 100 octane fuel at approximately room temperature and then allowed to drain for one minute before being tested per section 7.1. No cleaning other than the drainage specified above shall be accomplished prior to conducting subsequent tests.

7.8.2. *Oil immersion.* The same test shall be conducted with used SAE #60 oil.

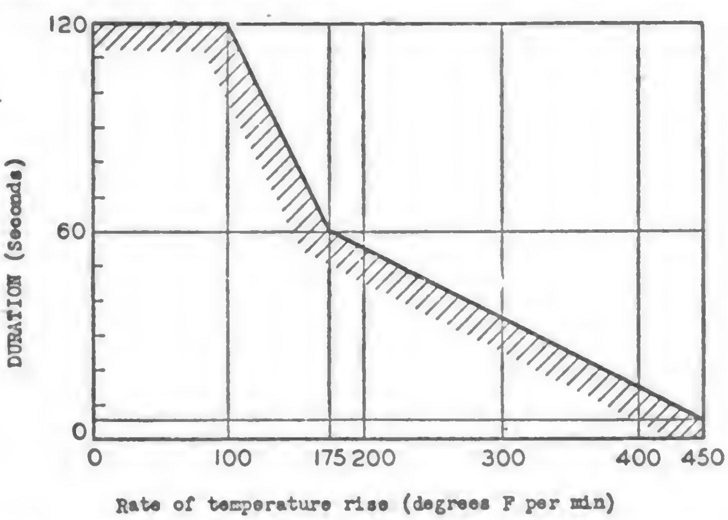


FIGURE 3 (a).—LOCAL TEMPERATURE RISE CONDITION (REFERENCE SEC. 7.3.1).

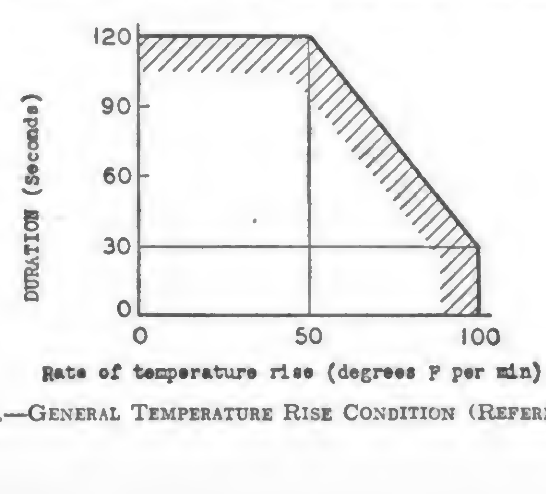


FIGURE 3 (b).—GENERAL TEMPERATURE RISE CONDITION (REFERENCE SEC. 7.3.2).

7.9. *Sand.* All parts of the instrument which may be installed in exposed portions of the airplane (such as in nacelles, wheel wells, etc.) shall be subjected to a sand or dust laden air stream, flowing at a constant rate of 2½ pounds per hour, for four hours. The stream shall be formed of sand or dust that has been sifted through a 150 mesh screen and shall pass over all parts of the units under test. The test chamber shall be equivalent to that shown in Figure 1.

7.10. *High temperature.* All components of the instrument which may be located in engine compartments shall be exposed to a temperature of 130° C. for 48 hours prior to being tested per section 7.1 except a 130° C. All other components shall be subjected to a similar test at 70° C.

7.11. *Low temperature.* The instrument shall be exposed to a temperature of −65° C. for a period of 24 hours, after which it shall be raised to a temperature of −55° C. for a period of six hours prior to being tested per section 6.1 except at −55° C. However, compliance with section 7.1 shall be considered to have been accomplished in this case if the time of response does not exceed 10 seconds.

7.12. *Altitude effects.*

7.12.1. *High altitude and rate of climb.* The instrument shall be subjected to a pressure that is varied from normal atmospheric pressure to an altitude pressure equivalent to 40,000 feet at a rate of not less than 3,000 feet per minute. The instrument shall be maintained at the altitude pressure equivalent to 40,000 feet for a period of 48 hours. The instrument shall then be returned to sea level conditions and then tested per section 7.1. Sealed units shall not leak as a result of exposure to this pressure. Where applicable, this shall be demonstrated by immersion in water after the test.

7.12.2. *Low altitude.* The instrument shall be subjected to the same test as outlined in section 7.12.1, except that the rate of pressure variation need not be as specified therein and the pressure shall be maintained at an altitude pressure equivalent to −1,000 feet.

7.12.3. *Pressurization test.* All components of the instrument which may be located in pressurized area shall be subjected to an external pressure of 8 p. s. i. for a period of fifteen minutes. The response time test of 7.1.1 shall be conducted while the components involved are under the 8 p. s. i. pressure.

7.13. *Voltage variation.* The instrument shall be operated with the voltage varying from 110% to 75% of the rated. The instrument shall then be tested per section 6.1 under these conditions. Compliance with the provisions of section 4.2 shall also be demonstrated.

7.14. *Flame.* The detecting element of the instrument shall be subjected to a completely enveloping flame at a temperature of 1,100° C. minimum for two periods of one minute each. The flame shall be as specified in Figure 2. The instrument shall be cooled to approximately room temperature or to the ambient temperature permitted in section 7.2 after each exposure to flame. The instrument shall then be exposed to the same flame a third time. An alarm shall be signalled in not more than five seconds after each exposure to flame. During cooling of the instrument after the first two exposures to flame the alarm shall clear in not more than 45 seconds after the flame has been removed in the first two cases. Artificial means of cooling the instrument shall not be used until after the alarm has cleared. A manual resetting device may be used to clear the alarm provided it is demonstrated that the resetting device will clear the alarm only if the flame has been removed; i. e., if flame is still present and the manual resetting device is operated, the instrument must continue to indicate the presence of a fire. The instrument need not clear the alarm and need not be capable of further operation after the third exposure to flame. During this test the sensing element shall be subjected to vibration as specified in section 7.5.

(2) *Exceptions.* Item (b) of section 3.3, "Identification," need not be complied with for conformance with the terms of this order.

(3) *Application.* (i) Fire detectors complying with the specifications appearing in this Technical Standard Order are hereby approved for all aircraft for protection of aircraft power plant installations, combustion heaters, or other installations where fuel, oil or similar fires may occur. Fire detectors already approved by the Administrator may continue to be installed in aircraft:

(*a*) For which an application for original type certificate is made prior to the effective date of this order,

(*b*) The prototype of which is flown within 1 year after the effective date of this order, and

(*c*) The prototype of which is not flown within 1 year after the effective date of this order if due to causes beyond the applicant's control provided application for a type certificate is made prior to the effective date of this order.

(ii) If a major change is made in the installation within 9 months after the effective date of this order involving a change in type or model of fire detector, previously approved types of fire detectors may be installed. However, in any such change made after the 9-month period, new types of fire detectors installed in aircraft shall meet the specifications contained herein.

(c) *Specific instructions.*

(1) *Marking.* In addition to the identification information required in the referenced specification (see paragraph (b) (2) above), each fire detector shall be permanently marked with the Technical Standard Order designation "CAA-TSO-C11" to identify the fire detector as meeting the requirements of this order in accordance with the manufacturer's statement of conformance outlined below. This identification will be accepted by the Civil Aeronautics Administration as evidence that the established minimum safety requirements for fire detectors have been met.

(2) *Data requirements.* Ten copies of the following technical information shall be submitted by the manufacturer of the fire detector with his statement of conformance to the Civil Aeronautics Administration, Aircraft Service, Attn: A-298, Washington 25, D. C. These data shall consist of all information such as descriptive data, drawings, diagrams, etc., which are necessary to define the limitations of use for which the fire detectors are satisfactory, and which are essential to outline the conditions for their proper installation and operation. They shall include at least the following, wherever applicable, in addition to other limitations which may apply:

(i) Maximum allowable normal ambient temperature at the point of detector location.

(ii) Maximum allowable rate of temperature rise at point of detector location as a result of normal operation.

(iii) Electrical circuit arrangement.

(iv) Operating voltage.

(v) Mounting or support method.

(vi) Maximum or minimum number of units or detector length which can be used in one circuit or one fire zone without adversely affecting sensitivity or causing false indications due to temperature variations associated with normal operation.

(3) *Effective date.* After August 1, 1948, specifications contained in this Technical Standard Order will constitute the basis for Civil Aeronautics Administration approval of fire detectors for use in certificated aircraft.

(4) *Deviations.* Requests for deviation from, or waiver of, the requirements of this order, which affect the basic airworthiness of the component, should be submitted for approval by the Director, Aircraft Service, Office of Aviation Safety, Civil Aeronautics Administration. These requests should be addressed to the nearest regional office of the Civil Aeronautics Administration, Attn: Superintendent, Aircraft Branch.

(5) *Conformance.* (i) The manufacturer shall furnish to the CAA (address as noted in paragraph (c) (2) above), a written statement of conformance signed by a responsible official of his company, setting forth that the fire detector to be produced by him meets the minimum safety requirements established in this order. Immediately thereafter distribution of the fire detector conforming with the terms of this order may be started and continued.

(ii) The prescribed identification on the fire detector does not relieve the aircraft manufacturer or owner of responsibility for the proper application of the fire detector in his aircraft, nor waive any of the requirements concerning type certification of the aircraft in accordance with existing Civil Air Regulations.

(iii) If complaints of nonconformance with the requirements of this order are brought to the attention of the Civil Aeronautics Administration and investigation indicates that such complaints are justified, the Administrator will take appropriate action to restrict the use of the product involved.

(iv) Copies of this Technical Standard Order and other Technical Standard Orders may be obtained from the Civil Aeronautics Administration, Aviation Information Staff, Washington 25, D. C.

[13 F. R. 3857, 7728]

§ 4b.448-3 *Technical Standard Order TSO-C17: "Fire-Resistant Aircraft Material" (CAA rules which apply to § 4b.448 (b))*—(a) *Introduction.* (1) Fire-resistant aircraft material is in the class of aircraft components which the Administrator of Civil Aeronautics is authorized to approve in accordance with Parts 3, 4a, 4b, and 6 of this subchapter.

(2) This Technical Standard Order is intended to serve as a criterion by which the product manufacturer can obtain Civil Aeronautics Administration approval of his fire-resistant aircraft material.

(3) In the establishment of this Technical Standard Order, consideration has been given to existing Government and industry standards for fire-resistant aircraft material for the purpose of adopting the performance requirements of one of the recognized aeronautical standards as the minimum safety requirements for fire-resistant materials which are intended for use in civil aircraft. The specification of the Society of Automotive Engineers for fire-resistant aircraft materials contains such requirements.

(b) *Directive.*

(1) *Provision.* Pursuant to §§ 3.31, 3.625, 4a.31, 4a.400, 4b.41, 4b.447, 4b.448, 4b.592, 4b.623, 4b.654, 4b.665, 4b.676, 6.6, and 6.47 of the Civil Air Regulations, which authorize the Administrator to approve aircraft material, the performance requirements for fire-resistant aircraft material as set forth in section 3 of SAE Specification AMS-3851, Fire-Resistant Properties for Aircraft Materials, dated May 1, 1948,[1] stated below, are hereby established as minimum safety requirements for fire-resistant material which is intended for use in civil aircraft.

1. *Acknowledgment.* A vendor shall mention his specification number in all quotations and when acknowledging purchase orders.

2. *Application.* Primarily intended to cover materials which may be used without further treatment in areas in air carrier aircraft where a fire-resistant material is required.

3. *Technical requirements.* The material as supplied shall be capable of meeting the following test:

If the material is rigid an 8 x 8 in. specimen shall be used. If flexible, the material shall be placed in a frame, exposing an area 8 x 8 in. Where backing material is used, the specimen shall be provided with the same backing. The test specimen shall be supported at an angle of 45 degrees. The Bunsen or Tirrill burner shall rest upon a horizontal surface. The burner shall be adjusted for no air intake, giving a yellow tipped, 1½ in. flame. Suitable precautions shall be taken to avoid drafts. The period of application shall be 30 sec with ⅓ of the flame in contact with the material at the approximate center of the specimen. Upon removal of the flame source from the specimen, the flame shall extinguish itself within 15 sec and no smoldering or glowing shall be visible 10 sec thereafter. No complete penetration of the material shall result.

4. *Reports.* Unless otherwise specified, the vendor shall furnish, with the original sample submitted for approval, three copies of a notarized report of the results of the test noted above showing duration of flaming, time of smoldering, char width, and penetration. After approval, unless otherwise specified, vendor shall furnish with each shipment three copies of a notarized report of the results of the above test made on each grade or type of each lot or shipment of material contained in the order. This report shall include the purchase order number, this specification number, vendor's material number, and quantity.

5. *Packing and identification.*

5.1 Packaging shall be accomplished in such a manner as to insure that the materials being shipped will not be torn or damaged and will be protected against exposure and undue weathering and harmful materials of any kind.

5.2 Each package shall be permanently and legibly marked, and the material tagged or stamped to give the following information:

Material description ______________________
AMS 3851
Meets fire resistance requirement AMS 3851
Vendor's identification ____________________
Purchase order number ____________________

6. *Approval.* A vendor shall not supply material until samples have been approved by the purchaser. After approval changes in

[1] Copies may be obtained from the Society of Automotive Engineers, 29 West 39th St., New York, N. Y.

composition, production manufacturing procedures and processes shall not be made without prior written approval by purchaser. Results of tests on incoming shipments shall be essentially equal to those obtained on approved samples.

7. *Rejections.* Material not conforming to this specification or to authorized modifications will be subject to rejection. Unless otherwise stipulated, rejected material will be returned to vendor at vendor's expense, unless purchaser receives, within three weeks of notification of rejection, other instructions for disposition.

(2) *Application.* Fire-resistant materials complying with the specifications appearing in this Technical Standard Order are hereby approved for all aircraft. Mandatory dates for the installation of such material are provided in §§ 41.20 (f), 42.10 (b) and 61.31 (b) (2) of the Civil Air Regulations.

(c) *Specific instructions.*

(1) *Marking.* In addition to the identification information required in the referenced specification, the material shall be permanently marked with the Technical Standard Order designation "CAA-TSO-C17" to identify the materials as meeting the requirements of this order in accordance with the manufacturer's statement of conformance outlined below. This identification will be accepted by the Civil Aeronautics Administration as evidence that the established minimum safety requirements for fire-resistant materials have been met.

(2) *Data requirements.* None.

(3) *Effective date.* See paragraph (b) (2) of this section.

(4) *Deviations.* Requests for deviation from, or waiver of, the requirements of this order, which affect the basic airworthiness of the component, should be submitted for approval by the Director, Aircraft Service, Office of Aviation Safety, Civil Aeronautics Administration. These requests should be addressed to the nearest regional office of the Civil Aeronautics Administration, Attn: Superintendent, Aircraft Branch.

(5) *Conformance.* (i) The manufacturer shall furnish to the Civil Aeronautics Administration, Aircraft Service, A-298, Washington 25, D. C., a written statement of conformance signed by a responsible official of his company, setting forth that the fire-resistant material to be produced by him meets the minimum safety requirements established in this order. Immediately thereafter distribution of the material conforming with the terms of this order may be started and continued.

(ii) The prescribed identification on the fire-resistant material does not relieve the aircraft manufacturer or owner of responsibility for the proper application of the fire-resistant material in his aircraft, nor waive any of the requirements concerning type certification of the aircraft in accordance with existing Civil Air Regulations.

(iii) If complaints of nonconformance with the requirements of this order are brought to the attention of the Civil Aeronautics Administration, and investigation indicates that such complaints are justified, the Administrator will take appropriate action to restrict the use of the product involved.

(iv) Copies of this Technical Standard Order and other Technical Standard Orders may be obtained from the Civil Aeronautics Administration, Aviation Information Staff, Washington 25, D. C.

[13 F. R. 7728]

§ 4b.448-4 *Technical Standard Order TSO-C19: "Portable Water-Solution Type Fire Extinguishers" (CAA rules which apply to § 4b.448 (b) (2) (i) and (ii))*—(a) *Introduction.* Under section 601 of the Civil Aeronautics Act of 1938, as amended, and §§ 4a.31, 4a.532, 4b.41, 4b.448 (b) (2) (i) and (ii) and 4b.691 (c) of this chapter, the Administrator of Civil Aeronautics is authorized to adopt standards for portable fire extinguishers intended for use in civil aircraft. In adopting these standards, consideration has been given to existing Government and industry standards for portable water-solution type fire extinguishers.

(b) *Directive*—(1) *Provision.* The performance requirements for portable water-solution type fire extinguishers, as set forth in sections 5 and 6 of SAE Specification AS-245 Water-Solution Type Hand Fire Extinguishers dated November 1, 1948,[1] stated below, are hereby established as minimum safety performance standards for portable water-solution type fire extinguishers intended for use in civil aircraft:

1. *Purpose.* To specify minimum requirements for a water solution type hand fire extinguisher which shall be suitable for use on incipient fires which may occur in an airplane cabin interior. The type of fire for which these units are intended is one involving combustible materials such as paper, textiles, and similar materials.

2. *Scope.* This specification covers two basic types as follows:

Type I	Stored pressure type.
Type II	Cartridge operated type.

3. *General requirements.*

3.1 *Material and workmanship.*

3.1.1 *Materials.* Materials shall be of a quality which experience or tests have demonstrated to be suitable and dependable for use in aircraft equipment and with extinguishing medium used.

3.1.2 *Workmanship.* Workmanship shall be consistent with high-grade aircraft equipment manufacturing practice.

3.2 *Identification.* The following information shall be legibly and permanently marked on the extinguisher:

(a) Name of extinguisher.
(b) SAE Spec. No. AS-245.
(c) Capacity.
(d) Test pressure of container.
(e) Manufacturer's part or model number.
(f) Manufacturer's name and/or trade mark.
(g) Operating and maintenance instructions.

3.3 *Environmental conditions.* The following conditions have been established as design requirements only. Tests shall be conducted as specified in sections 5 and 6.

3.3.1 *Temperature.* This extinguisher shall withstand, without deterioration temperatures from −40° F. to +140° F., and shall operate satisfactorily within that temperature range.

3.3.2 *Humidity.* The extinguisher shall function and shall not be adversely affected when exposed to any relative humidity in the range of from 0 to 95% at a temperature of approximately 90° F.

3.3.3 *Altitude.* The extinguisher shall function and not be adversely affected when subjected to a pressure and temperature range equivalent to −1,000 feet to +40,000 feet standard altitude, except as limited by the application of 3.3.1.

3.3.4 *Vibration.* When mounted in accordance with the extinguisher manufacturer's instructions the unit shall not be adversely affected when subjected to a vibration of 2,400 cycles per minute with a total excursion of 3/32", and when subjected to a vibration of 3,000 cycles per minute with a total excursion of 0.015 inch.

4. *Detail requirements.*

4.1 *Design.*

4.1.1 The extinguisher shall consist of:

Type I: A container having a dischargeable capacity of at least 1 3/8 quarts, a connection for pressurizing the unit and a means of controlling the discharge of the liquid content.

Type II: A container having a dischargeable capacity of at least 1 3/8 quarts, a suitable holder and releasing means for the cartridge, and a means of controlling the discharge of the liquid content.

4.1.2 The container shall be designed for a minimum burst pressure of 500 p. s. i.

4.1.3 The Type I unit shall be fitted with an AN connection in accordance with AN-C-71, or equivalent, for pressurizing the unit. A pressure gage to indicate the stored pressure shall also be provided. The gage range shall be at least 100 pounds above the charged pressure of the unit at 70° F.

4.1.4 Type II units shall use as a pressurizing means a carbon dioxide filled cartridge made in accordance with Specification AN-C-105, or equivalent, but in addition suitably winterized to insure operation at −40° F. A means shall be provided to readily release the carbon dioxide from the cartridge immediately prior to the use of the units. The torque required to release the cartridge shall not exceed 25 inch-pounds. The cartridge holder shall be designed so that it cannot be assembled if the cartridge is in the wrong position. The cartridge holder shall be designed so that a simple visual inspection will indicate whether a cartridge is in the holder.

4.1.5 The extinguisher shall be provided with a valve which will control the liquid discharge. The extinguisher shall be designed so that after the unit has been placed in operation it shall be completely controllable with one hand, including starting, stopping and directing the discharge stream. The force to operate the valve shall not exceed 3 pounds if the lever type is used. If a rotary type is used the torque required shall not exceed 25 inch-pounds.

4.1.6 Type I units shall be designed so that the maximum stored pressure at 70° F. shall not exceed 175 psi. Type II units shall be designed so that the instantaneous pressure developed at 70° F. when the cartridge is released into a filled unit shall not exceed 200 psi.

4.1.7 The extinguisher shall be designed so that it cannot be overfilled with extinguishing medium.

4.1.8 The extinguisher shall be provided with a satisfactory seal to indicate tampering and/or operation.

4.2 *Liquid charge:*

4.2.1 The liquid used as the extinguishing medium shall be as free from corrosive effects as practicable.

4.2.2 The fire extinguishing liquid shall be non-toxic and non-injurious to personnel and shall not form injurious toxic fumes when discharged on a fire.

4.2.3 The fire extinguishing liquid shall not deteriorate or lose its efficiency over a one-year period.

4.2.4 The fire extinguishing liquid shall have extinguishing qualities equal to or

[1] Copies may be obtained from the Society of Automotive Engineers, 29 West 39th St., New York, N. Y.

better than an equal quantity of water when used at 70° F.

4.2.5 A wetting agent may be used provided the resulting solution complies with all requirements of the specification.

4.3 *Discharge characteristics:*

4.3.1 At 70° F. the time of effective discharge for a full extinguisher shall be not less than 30 nor more than 45 seconds.

4.3.2 At 70° F., with the extinguisher nozzle approximately 4 feet above the floor, it shall throw a stream a horizontal distance of not less than 20 feet and maintain this range for at least three-quarters of the contents.

4.3.3 The extinguisher at 70° F. shall be capable of discharging three-quarters of its contents by directing the stream in any desired direction.

4.4 *Bracket.*

4.4.1 A bracket shall be furnished from which the extinguisher can be quickly and easily removed. The bracket shall be designed to hold the charged extinguisher against an acceleration force of 10 g. applied in any direction.

5. *Individual performance requirements.* All extinguishers, or components of same, shall be subjected to whatever tests the manufacturer deems necessary to demonstrate specific compliance with this specification, including the following requirements:

5.1 *Hydrostatic tests.* Each container shall be hydrostatically tested to 250 psi for a one minute period and shall show no leakage or detriment effects.

6. *Qualification tests.* As many extinguishers as deemed necessary by the manufacturer to demonstrate that all extinguishers will comply with the requirements of this section shall be tested. The tests of each extinguisher shall be conducted consecutively and after the tests have been initiated, no servicing (except recharging and repressurizing) or adjustments shall be permitted. For both types of extinguishers, these tests shall be conducted with a fully charged unit. The Type I units shall be pressurized to the recommended pressure at 70° F. The Type II units shall have the cartridge inserted in the holders.

6.1 *High temperatures.* The extinguisher shall be subjected to a temperature of 140° F. for a period of 6 hours and then discharged. The discharge characteristics shall not vary more than 25 percent from the figures in section 4.3.

6.2 *Low temperature.* The extinguisher shall be subjected to a temperature of −40° F. for a period of 6 hours and then discharged. The discharge characteristics shall not vary more than 40 percent from the figures in section 4.3.

6.3 *Vibration.* The extinguisher shall be placed in its bracket which shall be attached to a vibration stand. The vibration tests shall be conducted at 2,400 cycles per minute with a total excursion of $\frac{3}{32}$ inch and at 3,000 cycles per minute with a total excursion of 0.015 inch. The assembly shall be vibrated for a three hour period with its major axis vertical and for a similar period with its major axis horizontal. At the completion of the vibration tests, the extinguisher and bracket shall be examined to determine that no looseness in the units nor damage to a part has resulted. The extinguisher shall be discharged to determine compliance with the discharge characteristics of section 4.3.

6.4 *Fire tests.* The extinguishing medium shall be tested to determine compliance with the requirements of section 4.2.4.

(2) *Application.* (i) When portable fire extinguishers are required by this subchapter, water-solution type fire extinguishers complying with the specifications appearing in this Technical Standard Order are hereby approved for use in the compartments aft of the pilot compartment(s) in all civil aircraft in applications wherein the hazard is greatest from Class A fires (involving paper, textiles, and similar combustible materials). When substitution of portable water-solution type fire extinguishers for other types is contemplated for Class A fire protection, it shall be on a basis of one minimum $1\frac{3}{8}$-quart water-solution type fire extinguisher for each 1 quart carbon tetrachloride or the 2-pound carbon dioxide-type extinguisher. Portable water-solution type fire extinguishers already approved by the Administrator may continue to be installed in aircraft:

(*a*) For which an application for original type certificate is made prior to the effective date of this order,

(*b*) The prototype of which is flown within one year after the effective date of this order, and

(*c*) The prototype of which is not flown within one year after the effective date of this order if due to causes beyond the applicant's control.

(ii) If an alteration involving a change in type or model of portable water-solution fire extinguisher is made within nine months after the effective date of this order, previously approved types of portable water-solution type fire extinguishers may be installed. However, in any such change made after the nine month period, new types of portable water-solution type fire extinguishers installed shall meet the specifications contained herein.

(c) *Specific instructions*—(1) *Marking.* In addition to the identification information required in the referenced specification, each portable water-solution type fire extinguisher shall be permanently marked with the Technical Standard Order designation, CAA-TSO-C19, to identify the extinguisher as meeting the requirements of this order in accordance with the manufacturers' statement of conformance outlined below. This identification will be accepted by the Civil Aeronautics Administration as evidence that the established minimum safety requirements for portable water-solution type fire extinguishers have been met.

(2) *Data requirements.* None.

(3) *Effective date.* After June 1, 1949, specifications contained in this order will constitute the basis for Civil Aeronautics Administration approval of portable water-solution type fire extinguishers for use in certificated aircraft.

(4) *Deviations.* Requests for deviation from, or waiver of, the requirements of this order, which affect the basic airworthiness of the component, should be submitted for approval by the Chief, Aircraft Service, Office of Aviation Safety, Civil Aeronautics Administration. These requests should be addressed to the nearest Regional Office of the Civil Aeronautics Administration, Attn: Superintendent, Aircraft Branch.

(5) *Conformance.* (i) The manufacturer shall furnish to the Civil Aeronautics Administration, Aircraft Service, Attn: A-298, Washington 25, D. C., a written statement of conformance signed by a responsible official of his company, setting forth that the portable water-solution type fire extinguisher to be produced by him meets the minimum safety requirements established in this order. Immediately thereafter distribution of the extinguisher conforming with the terms of this order may be started and continued.

(ii) The prescribed identification on the portable water-solution type fire extinguisher does not relieve the aircraft manufacturer or owner of responsibility for the proper application of the extinguisher in his aircraft, nor waive any of the requirements concerning type certification of the aircraft in accordance with existing Civil Air Regulations.

(iii) If complaints of nonconformance with the requirements of this order are brought to the attention of the Civil Aeronautics Administration, and investigation indicates that such complaints are justified, the Administrator will take appropriate action to restrict the use of the product involved.

(iv) Copies of this Technical Standard Order and other Technical Standard Orders may be obtained from the Civil Aeronautics Administration, Aviation Information Staff, Washington 25, D. C.

[Supp. 4, 14 F. R. 3196]

§ 4b.451 *Pressure cabins.* When pressurized compartments are provided for the occupants of the airplane, the requirements of this section shall be met.

(a) *Strength.* (1) All parts of the airplane subjected to loads from both pressure differential and flight strength conditions shall be designed for limit loads corresponding to the flight limit loads combined with pressure differential loads from zero up to the maximum relief valve setting. The external pressure distribution on the cabin in flight shall be taken into account.

(2) If landings are to be permitted with the cabin pressurized, loads from the landing conditions shall be combined with pressure differential loads from zero up to maximum to be permitted during landing.

(3) As a separate condition, all parts of the airplane affected by pressure differential loads shall be designed for limit pressure differential loads corresponding to 1.33 times the maximum relief valve setting. All other loads shall be omitted in this case.

(4) When a pressurized cabin is separated into two or more compartments by bulkheads or floors, the primary structure shall be designed to withstand the effects of sudden release of pressure in any compartment having external doors or windows. This condition shall be investigated for the failure of the largest opening in a compartment and inter-compartment venting may be accounted for when provided.

(b) *Pressure supply.* If cabin pressurization is to be used in lieu of the regular use of oxygen at altitude in complying with the operating requirements of Parts 40, 41, and 61 of this subchapter the pressure supply shall be capable of maintaining a cabin pressure corresponding to an altitude of not more than 10,000 feet in standard atmosphere when the airplane altitude is any value up to the maximum for which certification is desired.

(c) *Pressure control.* Pressure cabins shall be provided with at least the following valves, controls, and indicators for controlling cabin pressure:

(1) At least two pressure relief valves, one or both of which may be the normal regulating valve, which will automatically limit the positive pressure differential to a predetermined value at the maximum rate of flow delivered by the pressure source. The combined capacity of these valves shall be such that the failure of any one valve to operate would not cause an appreciable rise in the pressure differential. The pressure differential is considered positive when the internal pressure is greater than the external.

(2) At least two reversed pressure differential relief valves (or equivalent) which will automatically prevent a negative pressure differential greater than that which would damage the structure. One negative pressure relief valve may be used if it is of simple design.

(3) Means shall be provided by which the pressure differential can be rapidly equalized.

(4) A suitable automatic or manual regulator for controlling the intake and/or exhaust air flow by means of which required internal pressures and air flow rates can be maintained.

(5) Instruments at an appropriate crew station showing the pressure differential, the absolute pressure in the cabin, and the rate of change of the absolute pressure.

(6) Suitable warning indications shall be provided at the appropriate crew station, which will indicate when the safe or preset limits on pressure differential and absolute cabin pressure are exceeded.

(7) If the structure has not been designed for pressure differentials up to the maximum relief valve setting in combination with landing loads (see § 4b.451 (a) (2) a suitable warning placard shall be provided at the appropriate crew station.

(d) *Tests.* (1) The complete pressure cabin, including doors and windows and valves, shall be tested as a pressure vessel for the pressure differential specified in § 4b.451 (a) (3).

(2) The following functional tests shall be performed up to the working pressures:

(i) Functional and capacity tests of the positive and negative pressure differential relief valves and the emergency release valve, simulating the condition of regulator valves closed.

(ii) Tests showing that all parts of the pressurization system would function properly under all possible conditions of pressure, temperature, and moisture up to the maximum altitude for which certification is desired.

(iii) Flight tests demonstrating the performance of the pressure supply, pressure and flow regulators, indicators, and warning signals in steady and stepped climbs and descents at rates corresponding to the maximum attainable without exceeding the operating limitations of the airplane, up to the maximum altitude for which certification is desired.

(iv) Tests showing that all doors and emergency exits operate properly after flights listed in paragraph (d) (2) (iii) of this section.

§ 4b.456 *Reinforcement near propellers.* Surfaces near propeller tips shall have sufficient strength and stiffness to withstand the effects of the induced vibration and of ice thrown from the propeller. Windows shall not be located in this area unless shown capable of withstanding the most severe ice impact likely to occur.

MISCELLANEOUS

§ 4b.461 *Leveling marks.* Suitable reference marks shall be provided for use in leveling the airplane when making weight and balance determinations on the ground.

SUBPART E—POWER-PLANT INSTALLATION; RECIPROCATING ENGINES

GENERAL

§ 4b.466 *Components.* (a) The power plant installation shall be considered to include all components of the airplane which are necessary for its propulsion. It shall also be considered to include all components which affect the control of the major propulsive units or which affect their safety of operation between normal inspections or overhaul periods.

(b) All components of the power-plant installation shall be constructed, arranged, and installed in a manner that will assure their continued safe operation between normal inspections or overhaul periods. Accessibility shall be provided to permit such inspection and maintenance as is necessary to assure continued airworthiness.

(c) Electrical interconnections shall be provided to prevent the existence of differences of potential between major components of the power-plant installation and other portions of the airplane.

§ 4b.466–1 *Reverse-thrust propeller (CAA policies which apply to § 4b.466).* In applying § 4b.466 (b), the Administrator will approve, as providing adequate safety, only those reverse-thrust propeller installations which conform in all details with the following standards:

(a) Exceptional pilot skill shall not be required in taxying or any condition in which reverse thrust is to be used.

(b) Recommended operating procedures and operating limitations and placards shall be established.

(c) Throttle movement shall be such that the motion is in the direction of the desired acceleration of the airplane.

(d) The airplane control characteristics shall be satisfactory with regard to control forces encountered, and buffeting shall not be such as to be likely to cause structural damage.

(e) The directional control shall be adequate using normal piloting skill.

(f) It shall be determined that no dangerous condition is encountered in the event of a sudden failure of one engine in any likely operating condition.

(g) The operating procedures and airplane configuration shall be such as to provide a reasonable safeguard against serious structural damage to parts of the airplane due to the reverse air flow.

(h) It shall be determined that the pilot's vision is not dangerously obscured under normal operating conditions on dusty or wet runways and where light snow is on the runway.

(i) It shall be impossible to place the propellers in the reverse-thrust position until the airplane is on the ground, unless it is demonstrated that it is safe to reverse the propellers in any likely flight condition. Consideration shall be given to possible rebound of the airplane following initial contact, at which point propeller reversal has taken place.

(j) The mechanism actuating the propeller and controlling the engine shall maintain sufficient power to keep the engine running at an adequate speed to prevent engine stalling during or after the propeller reversing operation.

(k) It shall not be possible under any likely condition to cause excessive overspeed of the propeller during the propeller-reversing operation.

(l) The propeller control arrangement shall be such as to provide adequate safeguards against inadvertent reversal of propellers.

(m) The engine cooling characteristics shall be satisfactory when operated within the operating limitations.

(n) If it is desired to certificate reverse thrust for use in taxying only, it will be permissible to omit requirement of items 3 and 9, if the following are complied with: Deliberate action with intent to reverse the propellers is required; and placard in plain view of pilot must warn not to reverse the propellers in the air and to be used for taxying only.

[12 F. R. 3438. Correction noted at 14 F. R. 37]

ENGINES AND PROPELLERS

ENGINES

§ 4b.471 *Engines.* Engines installed in certificated airplanes shall be of a type that has been certificated in accordance with the provisions of Part 13 of this subchapter.

§ 4b.472 *Engine isolation.* The engines shall be so isolated, each from the other, that the failure or malfunctioning of any engine, or any part of the power-plant installation serving any engine, will not prevent the safe operation of the remaining engine or engines.

§ 4b.473 *Control of engine rotation.* Means shall be provided for stopping and restarting the rotation of any engine individually in flight. All components provided for this purpose which are located on the engine side of the fire wall and might be exposed to fire, shall be of fire-resistant construction (see also § 4b.563).

PROPELLERS

§ 4b.474 *Type.* Propellers installed in certificated airplanes shall be of a type that has been certificated in accordance with the provisions of Part 14 of this subchapter.

§ 4b.475 *Propeller vibration.* The magnitude of the propeller blade vibration stresses under all normal conditions of operations shall be determined by actual measurement or by comparison with similar installations for which such measurements have been made. The vibration stresses thus determined shall not exceed values that have been demonstrated to be safe for continuous operation.

§ 4b.476 *Propeller pitch and speed limitations.* (a) The propeller pitch and speed shall be limited to values that will assure safe operation under all normal conditions of operation and will assure compliance with the performance requirements specified in §§ 4b.91–4b.114.

(b) A propeller speed limiting means shall be provided at the governor. Such means shall be set to limit the maximum possible governed engine speed to a value not exceeding the maximum permissible revolutions per minute.

(c) The low pitch blade stop in the propeller shall be set or other means used to limit the low pitch position, so as not to exceed 103% of the maximum permissible propeller shaft revolutions per minute under the following conditions:

(1) Propeller blades at the low pitch limit and governor inoperative.

(2) Engine operating at take-off manifold pressure with the airplane stationary under standard atmospheric conditions.

§ 4b.477 *Propeller clearance*—(a) *Ground clearance.* (1) Seven inches (for airplanes equipped with nose wheel type landing gears) or 9 inches (for airplanes equipped with tail wheel type landing gears) with the landing gear statically deflected and the airplane in the level, normal take-off, or taxying attitude, whichever is most critical.

(2) In addition to subparagraph (1) of this paragraph, there shall be positive clearance between the propeller and the ground when, with the airplane in the level take-off attitude, the critical tire is completely deflated and the corresponding landing gear strut is completely bottomed.

(b) *Water clearance.* A minimum clearance of 18 inches shall be provided unless compliance with § 4b.165 can be demonstrated.

(c) *Structural clearance.* (1) One inch radial clearance between the blade tips and the airplane structure, or whatever additional radial clearance is necessary to preclude harmful vibration of the propeller or airplane.

(2) One-half inch longitudinal clearance between the propeller blades or cuffs and stationary portions of the airplane. Adequate positive clearance shall be provided between other rotating portions of the propeller or spinner and stationary portions of the airplane.

§ 4b.478 *Propeller de-icing provisions.* Airplanes intended for operation under atmospheric conditions conducive to the formation of propeller ice shall be provided with means for the prevention and removal of such ice accumulations. If combustible fluid is used for propeller de-icing, the provisions of §§ 4b.651–4b.655 shall be complied with.

[Amdt. 04–0, 11 F. R. 71 as amended by Amdt. 04–1, 11 F. R. 11351]

FUEL SYSTEM

§ 4b.481 *General.* The fuel system shall be constructed and arranged in a manner to assure the provision of fuel to each engine at a flow rate and pressure which have been established for proper engine functioning under all normal conditions of operation including all maneuvers for which the airplane is intended.

ARRANGEMENT

§ 4b.482 *Fuel system arrangement.* Fuel systems shall be so arranged that any one fuel pump cannot draw fuel from more than one tank at a time unless means are provided to prevent introducing air into the system.

§ 4b.483 *Fuel system independence.* The fuel system shall be arranged to permit operation in such a manner that the failure of any one component will not result in the irrecoverable loss of the power of more than one engine. A separate fuel tank need not be provided for each engine to show compliance with this requirement if the Administrator finds that the fuel system incorporates features which provide equivalent safety.

§ 4b.484 *Pressure cross-feed arrangements.* Pressure cross-feed lines shall not pass through portions of the airplane devoted to carrying personnel or cargo unless means are provided to permit the flight personnel to shut off the supply of fuel to these lines, or unless the lines are enclosed in a fuel- and fume-proof enclosure that is ventilated and drained to the exterior of the airplane. Such enclosures need not be used if these lines incorporate no fittings on or within the personnel or cargo areas and are suitably routed or protected to safeguard against accidental damage. Lines which can be isolated from the remainder of the fuel system by means of valves at each end shall incorporate provisions for the relief of excessive pressures that may result from exposure of the isolated line to high ambient temperatures.

OPERATION

§ 4b.491 *Fuel flow rate.* (a) The ability of the fuel system to provide the required fuel flow rate shall be demonstrated when the airplane is in the attitude which represents the most adverse condition from the standpoint of fuel feed which the airplane is designed to attain. At least the following shall be considered in this regard:

(1) The normal ground attitude.

(2) Climb with take-off flaps (landing weight) and gear up, using take-off power, at speed V_2, as determined in § 4b.95 (b), at landing weight.

(3) Level flight at maximum continuous power or the power required for level flight at V_c, whichever is less.

(4) The attitude of glide at a speed of 1.3 V_{s_0}.

(b) During this test, fuel shall be delivered to the engine at a pressure not less than the minimum established for proper engine operation. The quantity of fuel in the tank being tested shall not exceed the amount established as the unusable fuel supply for that tank (as determined by demonstration of compliance with the provisions of § 4b.494, (see also §§ 4b.501 and 4b.713) plus whatever minimum quantity of fuel it may be necessary to add for the purpose of conducting the flow test. If a fuel flowmeter is provided, the meter shall be blocked during the flow test and the fuel shall flow through the meter bypass.

§ 4b.492 *Fuel flow rate for pump systems.* The fuel flow rate for pump systems (main and reserve supply) shall be 0.9 pound per hour for each take-off horsepower or 125% of the actual take-off fuel consumption of the engine, whichever is greater. This flow rate shall be applicable to both the primary engine-driven pump and to emergency pumps and shall be available when the pump is running at the speed at which it would normally be operating during take-off. In the case of hand-operated pumps, this speed shall be considered to be not more than 60 complete cycles (120 single strokes) per minute.

§ 4b.493 *Fuel flow rate for transfer systems.* The provisions of § 4b.492 shall also apply to transfer systems with the exception that the required fuel flow rate for the engine or engines involved shall be established upon the basis of maximum continuous power and speed instead of take-off power and speed.

§ 4b.494 *Determination of unusable fuel supply and fuel system operation on low fuel.* (a) The unusable fuel supply for each tank, used for take-off and landing, shall be established as not less than the quantity at which the first evidence of malfunctioning occurs under conditions specified below. (See § 4b.501.) Upon presentation of the airplane for test, the applicant shall stipulate the quantity of fuel with which he wishes to demonstrate compliance with this provision and shall also indicate which of the following conditions is most likely to be critical from the standpoint of establishing the unusable fuel supply. He shall also indicate the order in which the other conditions may be critical from this standpoint.

(1) Level flight at maximum continuous power or the power required for level flight at V_c, whichever is less.

(2) Climb with take-off flaps (landing weight) and gear up, using take-off power at speed V_2, as determined in § 4b.95 (b), at landing weight.

(3) Rapid application of maximum continuous power and subsequent transition to climb at speed V_2 as in subparagraph (2) of this paragraph, with retraction of flaps and gear from a power-off glide at 1.3 V_{s_0} with flaps and gear down, at minimum weight with sufficient fuel for demonstration.

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

(c) The unusable fuel supply for all tanks other than those used for take-off and landing shall be established as not less than the quantity at which the first evidence of malfunctioning occurs under the conditions specified in paragraph (a) (1) of this section. This may be a ground test.

§ 4b.495 *Fuel system hot weather operation.* There shall be no evidence of vapor lock or other malfunctioning when the airplane is operated with fuel at a temperature of not less than 110° F. and is climbed, at a climb speed not to exceed that which will permit compliance with the climb requirement specified in § 4b.102, to the altitude at which the one-engine-inoperative best rate of climb, expressed in feet per minute, is not more than 0.02 $V_{s_0}{}^2$ for airplanes with a maximum take-off weight of 40,000 lbs. or less, 0.04 $V_{s_0}{}^2$ for airplanes with a maximum take-off weight of 60,000 lbs. or more with a linear variation between 40,000 lbs. and 60,000 lbs. when climbing at the weight corresponding to operation with full fuel tanks, minimum crew, and only that ballast which may be necessary to maintain the center of gravity limits for which the airplane is to be certificated. Demonstration of compliance with this section shall be accomplished either in flight or by means of a ground installation which closely simulates conditions in flight. In case of a flight demonstration conducted in cold weather, the Administrator may request that fuel tank surfaces, fuel lines, and other fuel system parts which may be subjected to cooling action from cold air, be suitably insulated to simulate, insofar as practicable, flight in hot weather.

§ 4b.496 *Flow between interconnected tanks.* In the case of systems with tanks whose outlets are interconnected, it shall not be possible for fuel to flow between tanks in quantities sufficient to cause an overflow of fuel from the tank vent when the airplane is operated as specified in § 4b.494 (a) and the tanks are full.

FUEL TANKS

§ 4b.501 *General.* Fuel tanks shall be capable of withstanding without failure any vibration, inertia, fluid, and structural loads to which they may be subjected in operation. Flexible fuel tank liners shall be of an acceptable type or proven suitable for the particular application. The fuel tanks, as installed, shall be designed to withstand a minimum internal pressure of 3.5 pounds per square inch. Integral type fuel tanks shall be provided with adequate facilities for the inspection and repair of the tank interior. The total usuable capacity of the fuel tanks shall not be less than 0.15 gallon for each maximum continuous horsepower for which the airplane is certificated. The unusable capacity shall be considered to be the minimum quantity of fuel that will permit compliance with the provisions of § 4b.494. The fuel quantity gauge shall be adjusted to account for the unusable fuel supply as specified in § 4b.713. The weight of the unusable fuel supply shall be included in the empty weight of the airplane.

§ 4b.502 *Fuel tank tests.* (a) Fuel tanks shall be capable of withstanding the following pressure tests without failure or leakage. These pressures may be applied in a manner simulating the actual pressure distribution in service.

(1) Conventional metal tanks and nonmetallic tanks whose walls are not supported by the airplane structure: A pressure of 3.5 pounds per square inch, or the pressure developed during the maximum ultimate acceleration of the airplane with a full tank, whichever is greater.

(2) Integral tanks: A minimum pressure of 3.5 pounds per square inch shall be used unless the pressure developed during the maximum limit acceleration of the airplane with a full tank exceeds this amount, in which case a hydrostatic head, or equivalent test, shall be applied to duplicate the acceleration loads insofar as possible, but need not exceed 3.5 pounds per square inch on surfaces not exposed to the acceleration loading.

(3) Nonmetallic tanks whose walls are supported by airplane structure shall be tested to a pressure of 3.5 pounds per square inch when mounted in the airplane structure.

(b) Tanks with large unsupported or unstiffened flat areas shall be capable of withstanding the following tests, or other suitable tests, without leakage or failure. The complete tank assembly, together with its supports, shall be subjected to a vibration test when mounted in a manner simulating the actual installation. The tank assembly shall be vibrated for 25 hours at an amplitude of not less than 1/32 of an inch while filled two-thirds full of water. The frequency of vibration shall be 90% of the maximum continuous rated speed of the engine unless some other frequency within the normal operating range of speeds of the engine is more critical, in which case the latter speed shall be employed and the time of test shall be adjusted to accomplish the same number of vibration cycles. In conjunction with the vibration test, the tank assembly shall be rocked through an angle of 15° on either side of the horizontal (30° total) about an axis parallel to the axis of the fuselage. The assembly shall be rocked at the rate of 16 to 20 complete cycles per minute.

(c) In case of tanks with nonmetallic liners, a specimen liner of the same basic construction as that to be used in the airplane shall, when installed in a suitable representative test tank, satisfactorily withstand the slosh test in paragraph (b) of this section with fuel at a temperature of 110° F.

§ 4b.503 *Fuel tank installation.* (a) The method of support for fuel tanks shall not be such as to concentrate loads on unsupported tank surfaces resulting from the weight of the fuel in the tank. Pads shall be provided to prevent chafing between the tank and its supports. Materials employed for padding shall be nonabsorbent or shall be treated to prevent the absorption of fluids. If flexible tank liners are employed, they shall be so supported that the liner is not required to withstand fluid loads. Interior surfaces of compartments for such liners shall be smooth and free of projections which may cause wear of the liner unless provisions are made for protection of the liner at such points or unless the construction of the liner itself provides such protection.

(b) Spaces adjacent to the surfaces of the tank shall be ventilated consistent with the size of the compartment to avoid fume accumulation in the case of minor leakage, or if the tank is in a sealed compartment the ventilation may be limited to that provided by drain holes of sufficient size to prevent excessive pressure resulting from altitude changes.

(c) Location of fuel tanks shall comply with the provisions of § 4b.652. In addition, no portion of engine nacelle skin which lies immediately behind a major air egress opening from the engine compartment shall act as the wall of an integral tank. Fuel tanks shall be isolated from personnel compartments by means of fume- and fuel-proof enclosures.

[Amdt. 04-0, 11 F. R. 71, as amended by Amdt. 04-1, 11 F. R. 11351]

§ 4b.504 *Fuel tank expansion space.* Fuel tanks shall be provided with an expansion space of not less than 2% of the tank capacity. It shall not be possible inadvertently to fill the fuel tank expansion space when the airplane is in the normal ground attitude.

§ 4b.505 *Fuel tank sump.* (a) Each tank shall be provided with a sump having a capacity of not less than either 0.25% of the tank capacity or 1/16 of a gallon, whichever is greater.

(b) The fuel tank sump capacity specified above shall be effective with the airplane in the normal ground attitude. The fuel tank shall be constructed to permit drainage of any hazardous quantity of water from all portions of the tank to the sump when the airplane is in the ground attitude.

(c) Fuel tank sumps shall be provided with a drain to permit complete drainage of the sump on the ground. The drain shall discharge clear of all portions of the airplane and shall be provided with means for positively or automatically locking the drain in the closed position. The drain shall be readily accessible.

(d) An additional drain may be provided, if necessary, for tank drainage.

§ 4b.506 *Fuel tank filler connection.* The fuel tank filler connections shall be marked as specified in § 4b.902. Provision shall be made to prevent the entrance of fuel into the fuel tank compartment or any portions of the airplane other than the tank itself. Recessed fuel filler connections which retain any appreciable quantity of fuel shall be drained and the drain shall discharge clear of all portions of the airplane. The filler cap shall provide a fuel-tight seal.

§ 4b.507 *Fuel tank vents and carburetor vapor vents.* (a) Fuel tanks shall be vented from the top portion of the expansion space in such a manner that the tank is adequately vented under all normal flight conditions. Vent outlets shall be so located and constructed as to prevent the possibility of their being obstructed by ice or other foreign matter. The vent shall be so constructed as to preclude the possibility of siphoning fuel during normal operation. The vent shall be of sufficient size to permit the rapid relief of excessive differences of pressure between the interior and exterior of the tank. Air spaces of tanks whose outlets are interconnected shall also be interconnected. There shall be no points in the vent line where moisture may accumulate with the airplane in either the ground or level flight attitude unless proper drainage is provided. Vents and drainage shall not terminate at points where the discharge of fuel from the vent outlet will constitute a fire hazard or from which fumes may enter personnel compartments.

(b) Carburetors which are provided with vapor elimination connections shall be provided with a vent line which will lead vapors back to one of the fuel tanks. Satisfactory provisions shall be incorporated in the vent system to avoid stoppage by ice. If more than one fuel tank is provided and it is necessary to use the tanks in a definite sequence for any reason, the vapor vent return line shall lead back to the fuel tank used for take-off and landing.

§ 4b.508 *Fuel tank outlet.* The fuel tank outlet shall be provided with a strainer of from 8 to 12 meshes per inch, or a suitable strainer on the booster pump. The clear area of the fuel tank outlet strainer shall not be less than 5 times the area of the fuel tank outlet line. The diameter of the strainer shall not be less than the diameter of the fuel tank outlet. Finger strainers shall be installed in a manner to be accessible for inspection and cleaning.

FUEL PUMPS

§ 4b.511 *Fuel pump and pump installation.* (a) If fuel pumps are provided to maintain a supply of fuel to the engine, at least one pump for each engine shall be driven by the engine. Fuel pumps shall be adequate to meet the flow requirements of the applicable portions of §§ 4b.491–4b.493. Provision shall be made to maintain the fuel pressure at the inlet to the carburetor within the range of limits established for proper engine operation. When necessary for the maintenance of the proper fuel de- §§ 4b.491–4b.493. Provision shall be provided to transmit the carburetor air intake static pressure to the proper fuel pump relief valve connection. In such cases, to avoid erroneous fuel pressure reading, the gauge balance lines should be independently connected to the carburetor inlet pressure.

(b) Unless equivalent provisions are made to permit the system to continue to supply fuel to all engines in case of the failure of any positive displacement fuel system pump, the pump itself shall incorporate an integral bypass. Engine fuel injection pumps which are certificated as an integral part of the engine need not incorporate a bypass.

(c) Emergency fuel pumps shall be provided to permit supplying all engines with fuel in case of the failure of any one fuel system pump, unless the engine-driven pump has been approved with the engine and suitable precautions are taken to avoid vapor lock and pump cavitation. If the only pump used in the system is an engine fuel injection pump which has been certificated as an integral part of the engine, an emergency pump need not be provided. Emergency pumps shall be capable of complying with the same flow requirements as are prescribed for the main pumps. Hand emergency pumps shall not require excessive effort for their continued operation at the rate of 60 complete cycles (120 single strokes) per minute. Emergency pumps shall be available for immediate use in case of the failure of any other pump.

(d) If the engine-driven pumps are capable of maintaining flight up to 10,000 feet altitude and with 110° F. fuel without the aid of auxiliary pumps, the auxiliary pumps may be considered as emergency pumps.

LINES AND FITTINGS

§ 4b.516 *Fuel system lines and fittings.* Fuel lines shall be installed and supported in a manner that will prevent excessive vibration and will be adequate to withstand loads due to fuel pressure and accelerated flight conditions. Lines which are connected to components of the airplane between which relative motion may exist shall incorporate provisions for flexibility. Flexible connections in lines which may be under pressure and subjected to axial loading shall employ flexible hose assemblies rather than hose clamp connections. Flexible hose shall be of an acceptable type or proven suitable for the particular application.

§ 4b.517 *Lines and fittings in designated fire zones.* Fuel lines and fittings in all designated fire zones (see § 4b.651) shall comply with the provisions of § 4b.654.

[Amdt. 04-1, 11 F. R. 11351]

§ 4b.518 *Fuel valves.* In addition to the requirements contained in § 4b.653 for shut-off means, all fuel valves shall be provided with positive stops or suitable index provisions in the "on" and "off" positions and shall be supported in such a manner that loads resulting from their operation or from accelerated flight conditions are not transmitted to the lines connected to the valve.

[Amdt. 04-1, 11 F. R. 11351]

§ 4b.519 *Fuel strainer.* A fuel strainer shall be provided between the fuel tank outlet and the carburetor inlet. If an engine driven fuel pump is provided, the strainer shall be located between the tank outlet and the engine driven pump inlet. The strainer shall be accessible for drainage and cleaning, and the strainer screen shall be easily removable. The strainer shall be mounted in a manner that does not cause its weight to be supported by the connecting lines or by the inlet or outlet connections of the strainer itself.

DRAINS AND INSTRUMENTS

§ 4b.526 *Fuel system drains.* Drainage of the system shall be accomplished by fuel strainer drains and other drains as provided in § 4b.505. Drains shall discharge clear of all portions of the airplane and shall be provided with means for positively or automatically locking the drain in the closed position. All fuel system drains shall be accessible. If drainage of the strainer permits compliance with the foregoing, no additional drains need be provided unless a hazardous quantity of water or sediment may be trapped. (See also § 4b.655.)

[Amdt. 04-0, 11 F. R. 71, as amended by Amdt. 04-1, 11 F. R. 11351]

§ 4b.531 *Fuel system instruments.* See § 4b.691 (b) and §§ 4b.711–4b.713.

FUEL JETTISONING SYSTEM

§ 4b.536 *Fuel jettisoning system.* (a) If the maximum take-off weight for which the airplane is certificated exceeds 105% of its maximum landing weight, provision shall be made to permit the jettisoning of fuel from the maximum take-off to the maximum landing weight at a rate per minute of 1% of the maximum take-off weight, when the airplane is flown in the configurations specified below, except that the time required to jettison the fuel need not in any case be less than 10 minutes. The fuel jettisoning system shall permit the safe discharge of fuel clear of all portions of the airplane under the following conditions of flight at the maximum take-off weight and with flaps and gear up:

(1) Power-off glide at a speed of 1.4 V_{s_1}.

(2) Climb at the one-engine-inoperative speed with the critical engines on one side of the airplane inoperative, the other engines at maximum continuous power.

(3) Level flight at a speed of 1.4 V_{s_1}, if found necessary from tests in subparagraphs (1) and (2) of this paragraph.

(b) Unless it is demonstrated that flap position does not adversely affect fuel jettisoning, a placard shall be provided adjacent to the jettisoning control to warn flight personnel against jettisoning fuel while the flaps are lowered. A notation to this effect shall also be included in the airplane operating manual.

(c) No fire hazard shall exist during, or as the result of, the jettisoning operation. Neither fumes nor fuel shall enter any portion of the airplane and the jettisoning operation shall not adversely affect control. Compliance with these provisions shall be demonstrated in flight. It shall not be possible to jettison fuel in the tanks used for take-off and landing below the level providing 45 minutes flight at 75% maximum continuous power, except that all fuel may be jettisoned where an auxiliary control is provided independent of the main jettisoning control.

(d) The fuel jettisoning valve shall be so constructed as to permit the flight personnel to close the valve during any portion of the jettisoning operation. (See § 4b.638 for fuel jettisoning system controls.)

OIL SYSTEM

§ 4b.541 *General.* Each engine shall be provided with an independent oil system capable of supplying the engine with an ample quantity of oil at a temperature not exceeding the maximum which has been established as safe for continuous operation. The oil capacity of the system shall not be less than 1 gallon for every 30 gallons of fuel capacity unless provisions are made for transferring oil between tanks in flight or unless a reserve oil supply, which can be fed to any tank during flight, is provided. If either a reserve oil system or an oil transfer system is provided, the total oil capacity need not exceed 1 gallon for each 40 gallons of fuel capacity. Lower oil-fuel ratios may be used providing they can be substantiated by oil consumption data.

§ 4b.542 *Oil cooling.* Demonstration of the ability of the oil cooling provisions to maintain the oil inlet temperature to the engine at or below the maximum established value shall be accomplished in accordance with §§ 4b.576–4b.582.

OIL TANKS

§ 4b.546 *General.* Oil tanks shall be capable of withstanding without failure all vibration, inertia, and fluid loads to which they may be subjected in operation. Flexible oil tank liners shall be of an acceptable type or proven suitable for the particular application.

§ 4b.547 *Oil tank tests.* Oil tank tests shall be the same as fuel tank tests (see § 4b.502) except as follows:

(a) The 3½ pounds per square inch pressure specified in § 4b.502 shall be 5 pounds per square inch.

(b) In the case of tanks with nonmetallic liners, the test fluid shall be oil at a temperature of 250° F. rather than fuel as specified in § 4b.502 (c).

§ 4b.548 *Oil tank installation.* Oil tank installations shall comply with the provisions of § 4b.503 except that oil tanks may be located on the engine side of the fire wall.

§ 4b.549 *Oil tank expansion space.* Oil tanks shall be provided with an expansion space of not less than either 10% of the tank capacity or 0.5 gallon, whichever is greater. Reserve oil tanks which have no direct connection to any engine shall be provided with an expansion space which need not exceed, but shall not be less than, 2% of the tank capacity. It shall not be possible inadvertently to fill the oil tank expansion space when the airplane is in the normal ground attitude.

§ 4b.550 *Oil tank filler connection.* Oil tank filler connections shall be marked as specified in § 4b.902. Recessed oil filler openings which retain any appreciable quantity of oil shall be drained and the drain shall discharge clear of all portions of the airplane. The filler cap shall provide an oil-tight seal.

§ 4b.551 *Oil tank vent.* Oil tanks shall be vented from the top portion of the expansion space in such a manner that the tank is adequately vented under all normal flight conditions. Oil tank vents shall be so arranged that condensed water vapor that may freeze and obstruct the line cannot accumulate at any point. (See also § 4b.655.)

[Amdt. 04–0, 11 F. R. 71, as amended by Amdt. 04–1, 11 F. R. 11351]

§ 4b.552 *Oil tank outlet.* The oil tank outlet shall not be enclosed or covered by any screen or other guard that may impede the flow of oil. (See also § 4b.563.)

LINES, FITTINGS, AND ACCESSORIES

§ 4b.555 *Oil system lines and fittings.* Oil lines shall comply with the provisions of § 4b.516.

§ 4b.556 *Lines and fittings in designated fire zones.* Oil lines and fittings in all designated fire zones (see § 4b.651) shall comply with the provisions of § 4b.654.

[Amdt. 04–1, 11 F. R. 11351]

§ 4b.557 *Oil valves.* (a) Requirements of § 4b.653 for shut-off means shall be complied with. Closing of oil shut-off means shall not prevent feathering the propeller, unless equivalent safety provisions are incorporated.

(b) All oil valves shall be provided with positive stops or suitable index provisions in the "on" and "off" positions, and shall be supported in such a manner that loads resulting from their operation or from accelerated flight conditions are not transmitted to the lines attached to the valve.

[Amdt. 04–1, 11 F. R. 11351]

§ 4b.558 *Oil radiator.* (a) Oil radiators shall be capable of withstanding without failure any vibration, inertia, and oil pressure loads to which they may normally be subjected.

(b) Oil radiator air ducts shall be so located that flames issuing from normal openings of the engine nacelle in case of fire shall not impinge directly upon the radiator.

§ 4b.559 *Oil filters.* If the airplane is equipped with an oil filter, the filter shall be constructed or installed in such a manner that complete blocking of the flow through the filter element will not prevent the safe operation of the engine oil supply system.

§ 4b.560 *Oil system drains.* Accessible drains shall be provided to permit safe drainage of the entire oil system and shall incorporate means for positive or automatic locking in the closed position. (See also § 4b.655.)

[Amdt. 04–0, 11 F. R. 71, as amended by Amdt. 04–1, 11 F. R. 11351]

§ 4b.561 *Engine breather line.* Engine breather lines shall be so arranged that condensed water vapor which may freeze and obstruct the line cannot accumulate at any point. Breathers shall discharge in a location which will not constitute a fire hazard in case foaming occurs and so that oil emitted from the line will not impinge upon the pilots' windshield. The breather shall not discharge into the engine air induction system. (See also § 4b.655.)

[Amdt. 04–0, 11 F. R. 71, as amended by Amdt. 04–1, 11 F. R. 11351]

INSTRUMENTS

§ 4b.562 *Oil system instruments.* See §§ 4b.691, 4b.711, 4b.712, and 4b.715.

§ 4b.563 *Propeller feathering system.* If the propeller feathering system is dependent upon the use of the engine oil supply, provision shall be made to trap a quantity of oil in the tank in case the supply becomes depleted due to failure of any portion of the lubricating system other than the tank itself. The quantity of oil so trapped shall be sufficient to accomplish the feathering operation and shall be available only to the feathering pump. The ability of the system to accomplish feathering when the supply of oil has fallen to the above level shall be demonstrated. This propeller feathering demonstration may be made on the ground if desired.

COOLING

§ 4b.571 *General.* The power-plant cooling provisions shall be capable of maintaining the temperatures of major power-plant components, engine fluids, and the carburetor intake air within the established safe values under all conditions of ground and flight operation.

TESTS

§ 4b.576 *Cooling tests.* Compliance with the provisions of § 4b.571 shall be demonstrated under critical ground, water, and flight operating conditions. If the tests are conducted under conditions that deviate from the highest anticipated summer air temperature (see § 4b.577), the recorded power-plant temperatures shall be corrected in accordance with the provisions of §§ 4b.578 and 4b.579. The corrected temperatures determined in this manner shall not exceed the maximum established safe values. The fuel used during the cooling tests shall be of the minimum octane number approved for the engines involved and the mixture settings shall be those used in normal operation. The test procedures shall be as outlined in §§ 4b.580–4b.582.

§ 4b.577 *Maximum anticipated summer air temperatures.* The maximum anticipated summer air temperature (hot-day condition) shall be considered to be 100° F. at sea level and to decrease from this value at the rate of 3.6° F. per thousand feet of altitude above sea level until a temperature of −67° is reached, above which altitude the temperature will be held constant at −67° F.

§ 4b.578 *Correction factor for cylinder head, oil inlet, carburetor air, and engine coolant outlet temperatures.* These temperatures shall be corrected by adding the difference between the maximum anticipated summer air temperature and the temperature of the ambient air at the time of the first occurrence of maximum head, air, oil, or coolant temperature recorded during the cooling test. A correction factor other than 1.0 may be employed if it can be demonstrated to be applicable.

§ 4b.579 *Correction factors for cylinder barrel temperatures.* Cylinder barrel temperatures shall be corrected by adding 0.7 of the difference between the maximum anticipated summer air temperature and the temperature of the ambient air at the time of the first ocurrence of the maximum cylinder barrel temperature recorded during the cooling test. A correction factor other than 0.7 may be employed if it can be demonstrated to be applicable.

§ 4b.580 *Climb cooling test procedure.* (a) The climb cooling test shall be conducted with the critical engine inoperative and its corresponding propeller feathered. All remaining engines shall be operated at their maximum continuous power or at full throttle when above the critical altitude. After stabilizing temperatures in flight, the climb shall be started at or below the lower of the two following altitudes and shall be continued until at least 5 minutes after the occurrence of the highest temperature recorded:

(1) 1,000 feet below the engine critical altitude.

(2) 1,000 feet below the altitude at which the rate of climb, as established in § 4b.103 (b), at the maximum t[illegible]

weight, is equal to at least 0.02 $V_{s_0}^2$ for airplanes with a maximum take-off weight of 40,000 lbs. or less, 0.04 $V_{s_0}^2$ for airplanes with a maximum take-off weight of 60,000 lbs. or more, with a linear variation between 40,000 lbs. and 60,000 lbs.

(b) The climb shall be conducted at an air speed which does not exceed the speed used in establishing the rate of climb required in § 4b.103 (b). The climb cooling test may be conducted as a continuation of the take-off cooling test of § 4b.581.

§ 4b.581 *Take-off cooling test procedure.* If the time for which take-off power is used in establishing the take-off path of the airplane exceeds 2 minutes, the test of § 4b.580 shall be supplemented by demonstration of adequate cooling during take-off and subsequent climb with one engine inoperative. The take-off cooling test shall be conducted by stabilizing temperatures during level flight at 75% of maximum continuous power (all engines operating) with normal cowl flap and shutter settings for the conditions. After all temperatures have stabilized, the climb shall be started at the lowest practicable altitude and shall be conducted with one engine inoperative and the corresponding propeller feathered. The remaining engines shall be operated at take-off revolutions per minute and power (or full throttle when above the take-off critical altitude) for the same time interval as take-off power is used during determination of the take-off flight path (see § 4b.97). The power shall then be reduced to the maximum continuous power and the climb continued until at least 5 minutes after the occurrence of the highest temperature recorded. The speed used during take-off power operation shall not exceed the speed used during the determination of the take-off flight path.

§ 4b.582 *Cooling test procedure for flying boat water operation.* In the case of flying boats, adequate cooling shall be demonstrated during taxying downwind for 10 minutes at 5 miles per hour above the step speed.

LIQUID COOLING

§ 4b.586 *Independent systems.* (a) Each liquid cooled engine shall be provided with an independent cooling system. The coolant system shall be so arranged that no air or vapor can be trapped in any portion of the system other than the expansion tank, either during filling or during operation.

(b) No inflammable coolant shall be used.

[Amdt. 04-0, 11 F. R. 71, as amended by Amdt. 04-1, 11 F. R. 11351]

§ 4b.587 *Coolant tank.* A coolant tank shall be provided. The tank shall have a usable coolant capacity of not less than 1 gallon. Coolant tanks shall be capable of withstanding without failure all vibration, inertia, and fluid loads to which they may be subjected in operation. Coolant tanks shall be provided with an expansion space of not less than 10% of the total coolant system capacity. It shall not be possible inadvertently to fill the expansion space with the airplane in the normal ground attitude.

§ 4b.588 *Coolant tank tests.* Coolant tank tests shall be the same as fuel tank tests (see § 4b.502) except as follows:

(a) The 3.5 pounds per square inch pressure test of § 4b.502 (a) shall be replaced by either the sum of the pressure developed during the maximum ultimate acceleration with a full tank plus the maximum working pressure of the system, or 1.25 times the maximum working pressure of the system, whichever is greater.

(b) In the case of tanks with nonmetallic liners, the test fluid shall be coolant at operation temperature rather than fuel as specified in § 4b.502 (c).

§ 4b.589 *Coolant tank installation.* Coolant tanks shall be supported in such a manner that the tank loads will be distributed over a large portion of the tank surface. Pads shall be provided to prevent chafing between the tank and the support. Material used for padding shall be nonabsorbent or shall be treated to prevent the absorption of inflammable fluids.

§ 4b.590 *Coolant tank filler connection.* Coolant tank filler connections shall be marked as specified in § 4b.902. Recessed coolant filler connections which retain any appreciable quantity of coolant shall be drained and the drain shall discharge clear of all portions of the airplane.

§ 4b.591 *Coolant lines and fittings.* Coolant lines shall comply with the provisions of § 4b.516.

§ 4b.592 *Fire-resistant coolant lines and fittings.* If the coolant used will ignite and burn under the conditions of power-plant fires, all lines and fittings located within designated fire zones shall comply with the provisions of § 4b.654.

[Amdt. 04-1, 11 F. R. 11351]

§ 4b.592-1 *Fire-resistant aircraft material (CAA rules which apply to § 4b.592).* See §§ 4b.448-1, 4b.448-2, 4b.448-3.

[13 F. R. 7729]

§ 4b.593 *Coolant radiators.* Coolant radiators shall be capable of withstanding without failure any vibration, inertia, and coolant pressure loads to which they may be normally subjected. Radiators shall be supported in a manner that will permit expansion due to operating temperatures and that will prevent the transmittal of harmful vibration to the radiator. If the coolant employed is inflammable the air intake duct to the coolant radiator shall be so located that flames issuing from normal openings of the engine nacelle, in case of fire, shall not impinge directly upon the radiator.

§ 4b.594 *Coolant system drains.* One or more drains shall be provided to permit drainage of the entire coolant system, including the coolant tank, radiator, and the engine when the airplane is in the normal ground attitude. Drains shall discharge clear of all portions of the airplane and shall be provided with means for positively locking the drain in the closed position. Coolant system drains shall be accessible.

§ 4b.595 *Coolant system instruments.* See §§ 4b.691, 4b.711, 4b.712, and 4b.715.

INDUCTION SYSTEM

§ 4b.601 *General.* The engine air induction system shall permit supplying an adequate quantity of air to the engine under all conditions of operation. The induction system shall provide air in such a manner as to permit acceptable fuel metering and mixture distribution with the induction system valves in any position. Each engine shall be provided with an alternate air source unless equivalent safety can be demonstrated by other means. Air intakes may open within the cowling only if that portion of the cowling is isolated from the engine accessory section by means of a fire-resistant diaphragm, or if provision is made to prevent the emergence of backfire flames. Alternate air intakes shall be located in a sheltered position.

§ 4b.602 *Induction system de-icing and anti-icing provisions.* The engine air induction system shall incorporate means for the prevention and elimination of ice accumulations in accordance with the following provisions unless it can be demonstrated that equivalent safety can be obtained by a lower heat rise or by other means. It shall be demonstrated that compliance with the provisions outlined in the paragraphs (a) and (b) of this section can be accomplished when the airplane is operating in air at a temperature of 30° F. when the air is free of visible moisture.

(a) Airplanes equipped with altitude engines employing conventional venturi carburetors shall be provided with a preheater capable of providing a heat rise of 120° F. when the engine is operating at 60% of its maximum continuous power.

(b) Airplanes equipped with altitude engines employing carburetors which embody features tending to reduce the possibility of ice formation shall be provided with a preheater capable of providing a heat rise of 100° F. when the engine is operating at 60% of its maximum continuous power.

§ 4b.603 *Carburetor air preheater design.* Means shall be provided to assure adequate ventilation of the carburetor air preheater when the engine is being operated on cold air. The preheater shall be constructed in such a manner as to permit inspection of exhaust manifold parts which it surrounds and also to permit inspection of critical portions of the preheater itself.

§ 4b.604 *Induction system ducts.* Induction system ducts ahead of the first stage of the supercharger shall be provided with drains which will prevent the hazardous accumulation of fuel or moisture in the ground attitude. Sufficient strength shall be incorporated in the ducts to prevent induction system failures resulting from normal backfire conditions. Drains shall not discharge in a location that will constitute a fire hazard. Ducts which are connected to components of the airplane between which relative motion may exist shall incorporate provisions for flexibility.

§ 4b.605 *Induction system screens.* If induction system screens are employed, they shall be located upstream from the carburetor. It shall not be possible for fuel to impinge upon the screen. Screens shall not be located in portions of the induction system which constitute the only passage through which air may reach the engine unless the screen is so located that it can be de-iced. De-icing of screens by means of alcohol shall not be considered acceptable.

§ 4b.606 *Carburetor air cooling.* Installations employing two stage superchargers shall be provided with means to maintain the air temperature at the inlet to the carburetor at or below the maximum established value. Demonstration of compliance with this provision shall be accomplished in accordance with §§ 4b.576–4b.582.

§ 4b.607 *Inter-coolers and after-coolers.* Inter-coolers and after-coolers shall be capable of withstanding without failure any vibration, inertia, and air pressure loads to which they may be subjected in operation.

EXHAUST SYSTEM

§ 4b.611 *General.* (a) The exhaust system shall be constructed and arranged in such a manner as to assure the safe disposal of exhaust gases without the existence of a hazard of fire or carbon monoxide contamination of air in personnel compartments.

(b) Unless suitable precautions are taken, exhaust system parts shall not be located in hazardous proximity to portions of any systems carrying inflammable fluids or vapors nor shall they be located under portions of such systems which may be subject to leakage. All airplane components upon which hot exhaust gases may impinge, or which may be subjected to high temperatures due to proximity to exhaust system parts, shall be constructed of heat resistant materials. All exhaust system components shall be separated from adjacent portions of the airplane, which are outside the engine compartment, by means of fire-resistant shields.

(c) Exhaust gases shall not be discharged at a location that will cause a glare seriously affecting pilot visibility at night, nor shall they discharge within dangerous proximity of any fuel or oil system drains.

(d) All exhaust system components shall be ventilated to prevent the existence of points of excessively high temperature.

§ 4b.612 *Exhaust piping.* Exhaust piping shall be constructed of material suitably resistant to heat and corrosion and shall incorporate provisions to prevent failure due to expansion when heated to operating temperatures. Exhaust pipes shall be supported in a manner adequate to withstand all vibration and inertia loads to which they may be subjected in operation. Portions of the exhaust piping, which are connected to components between which relative motion may exist, shall incorporate provisions for flexibility.

§ 4b.613 *Exhaust heat exchangers.* (a) Exhaust heat exchangers shall be constructed and installed in such a manner as to assure their ability to withstand without failure all vibration, inertia, and other loads to which they may normally be subjected. Heat exchangers shall be constructed of materials that are suitable for continued operation at high temperatures and that are resistant to corrosion due to products contained in exhaust gases.

(b) Provision shall be made for the inspection of all critical portions of exhaust heat exchangers, particularly if a welded construction is employed. Heat exchangers shall be adequately cooled whenever they are subject to contact with exhaust gases.

§ 4b.614 *Exhaust heating of ventilating air.* If an exhaust heat exchanger is used for heating ventilating air, a secondary heat exchanger shall be provided between the primary exhaust gas heat exchanger and the ventilating air system, unless it can be demonstrated that sufficient safety can be obtained by other means.

§ 4b.615 *Exhaust driven turbo-superchargers.* Exhaust driven turbines shall be of an acceptable type or proven suitable for the particular application and shall be installed and supported in a manner to assure their safe operation between normal inspection or overhaul periods. Provisions for expansion and flexibility shall be made between exhaust conduits and the turbine. Provision shall also be made for cooling of turbine parts whose temperature is critical and for lubrication of the turbine. Means shall be provided for automatically limiting the turbine speed to its maximum allowable overspeed value.

FIRE WALL AND COWLING

§ 4b.621 *Fire walls.* All engines, auxiliary power units, fuel-burning heaters, and other combustion equipment which are intended for operation in flight shall be isolated from the remainder of the airplane by means of fire walls or shrouds, or other equivalent means.

[Amdt. 04-1, 11 F. R. 11351]

§ 4b.622 *Fire-wall construction.* (a) Fire walls and shrouds shall be constructed in such a manner that no hazardous quantity of air, fluids, or flame can pass from the engine compartment to other portions of the airplane. All openings in the fire wall or shroud shall be sealed with close-fitting fireproof grommets, bushings or fire-wall fittings.

(b) Fire walls and shrouds shall be constructed of fireproof material and shall be protected against corrosion. The following materials have been found to comply with this section:

(1) Heat- and corrosion-resistant steel 0.015 inch thick;

(2) Low carbon steel, suitably protected against corrosion, 0.018 inch thick.

[Amdt. 04-1, 11 F. R. 11351]

§ 4b.623 *Cowling.* (a) Cowling shall be constructed and supported in such a manner as to be capable of resisting all vibration, inertia, and air loads to which it may normally be subjected. Provision shall be made to permit rapid and complete drainage of all portions of the cowling in all normal ground and flight attitudes. Drains shall not discharge in locations constituting a fire hazard.

(b) Cowling, unless otherwise specified by these regulations, shall be constructed of fire-resistant material. Those portions of the cowling which are subjected to high temperatures due to their proximity to exhaust system parts or exhaust gas impingement shall be constructed of fireproof material.

[Amdt. 04-0, 11 F. R. 71, as amended by Amdt. 04-1, 11 F. R. 11351]

§ 4b.623-1 *Fire-resistant aircraft material (CAA rules which apply to § 4b.623).* See § 4b.448-3.

[13 F. R. 7729]

§ 4b.624 *Engine accessory section diaphragm.* Unless equivalent protection can be demonstrated by other means, a diaphragm shall be provided on air-cooled engines, to isolate the engine power section and all portions of the exhaust system from the engine accessory compartment. This diaphragm shall comply with the provisions of § 4b.622.

POWER-PLANT CONTROLS AND ACCESSORIES

CONTROLS

§ 4b.631 *Power-plant controls.* All power-plant controls shall comply with the provisions of § 4b.424 with respect to location, grouping, and direction of motion and shall comply with the provisions of § 4b.898 with respect to marking. Controls shall be so located that they cannot be inadvertently operated by personnel entering or leaving the airplane, or while the flight personnel are making normal movements in the cockpit. Controls shall maintain any desired position without constant attention by the flight personnel and shall not tend to creep due to control loads or vibration. Flexible controls shall be of an acceptable type or proven suitable for the particular application. Controls shall have adequate strength and rigidity to withstand operating loads without failure or excessive deflection.

§ 4b.632 *Throttle controls.* A separate throttle control shall be provided for each engine. Throttle controls shall afford a positive and immediately responsive means of controlling the engines. Throttle controls shall be grouped and arranged in such a manner as to permit separate control of each engine and also simultaneous control of all engines.

§ 4b.633 *Ignition switches.* Ignition switches shall provide control for each ignition circuit on each engine. Means shall be provided for quickly shutting off all ignition by the grouping of switches or by providing a master ignition control. If a master control is provided, a suitable guard shall be incorporated to prevent its inadvertent operation.

§ 4b.634 *Mixture controls.* If mixture controls are provided, a separate control shall be provided for each engine. The controls shall be grouped and arranged in such a manner as to permit separate control of each engine and also simultaneous control of all engines.

§ 4b.635 *Propeller speed and pitch controls.* (See also § 4b.476 (a).) It shall be possible to control the propellers separately. The controls shall be grouped and arranged in such a manner as to permit control of the propellers separately and together. The controls shall permit ready synchronization of all propellers.

§ 4b.636 *Propeller feathering controls.* A separate control shall be provided for each propeller. Propeller feathering controls shall be provided with means to prevent inadvertent operation. If feathering is accomplished by movement of the normal pitch or speed control lever, provision shall be made to prevent the movement of this control to the feathering position during normal operation.

§ 4b.637 *Propeller reversing controls.* If the propeller blades can be placed in a pitch position which will produce negative thrust, reversing controls shall be so arranged as to prevent inadvertent operation.

§ 4b.638 *Fuel system controls.* (See § 4b.518.) Fuel jettisoning system controls shall be provided with guards to prevent their inadvertent operation. Such controls shall not be located in close proximity to fire extinguisher controls or any other controls intended for operation in order to combat a fire.

[Amdt. 04-0, 11 F. R. 71, as amended by Amdt. 04-1, 11 F. R. 11351]

§ 4b.639 *Carburetor air reheat controls.* Separate controls shall be provided to regulate the temperature of the carburetor air for each engine.

ACCESSORIES

§ 4b.641 *Power-plant accessories.* (a) Engine mounted accessories shall be of a type satisfactory for installation on the engine involved and shall utilize the provisions made on the engine for the mounting of such units.

(b) Items of electrical equipment subject to arcing or sparking shall be installed so as to minimize the possibility of their contact with any inflammable fluids or vapors which may be present in a free state.

§ 4b.642 *Engine ignition systems.* (a) Battery ignition systems shall be supplemented with a generator which is automatically made available as an alternate source of electrical energy to permit continued engine operation in the event of the depletion of any battery.

(b) The capacity of batteries and generators shall be sufficient to meet the simultaneous demands of the engine ignition system and the greatest demands of any airplane electrical system components which may draw electrical energy from the same source. Consideration shall be given to the condition of an inoperative generator and to the condition of a completely depleted battery when the generator is running at its normal operating speed. If only one battery is provided, consideration shall also be given to the condition in which the battery is completely depleted and the generator is operating at idling speed.

(c) Means shall be provided to warn the appropriate flight personnel if malfunctioning of any part of the electrical system is causing the continuous discharging of a battery that is necessary for engine ignition. (See § 4b.633 for ignition switches.)

POWER-PLANT FIRE PROTECTION

§ 4b.651 *Zones.* (a) Designated fire zones comprise the following regions:

(1) Engine power section.

(2) Engine accessory section.

(3) Complete power-plant compartments in which no isolation is provided between the engine power section and the engine accessory section.

(4) Auxiliary power unit compartments.

(5) Fuel-burning heater and other combustion equipment installations.

(b) Such zones shall be protected from fire by compliance with the requirements in §§ 4b.652–4b.655.

[Amdt. 04b-7, 12 F. R. 5960]

INFLAMMABLE FLUIDS

§ 4b.652 *Location of tanks.* No tanks or reservoirs which are a part of a system containing inflammable fluids or gases shall be located in designated fire zones, except where the fluid contained, the design of the system, the materials used in the tank, the shut-off means, all connections, lines, and controls are such as to provide equivalent safety. Not less than ½ inch of clear air space shall be provided between any tank or reservoir and a fire wall or shroud isolating a designated fire zone.

[Amdt. 04-1, 11 F. R. 11351]

§ 4b.653 *Shut-off means.* (a) Means for each individual engine shall be provided for shutting off or otherwise preventing hazardous quantities of fuel, oil, de-icer, and other inflammable fluids from flowing into, within, or through any designated fire zone, except that means need not be provided to shut off flow in lines forming an integral part of an engine. In order to facilitate rapid and effective control of fires such shut-off means shall permit an emergency operating sequence which is compatible with the emergency operation of other equipment, such as feathering the propeller. Shut-off means shall be located outside of designated fire zones, unless equivalent safety is provided (see § 4b.652), and it shall be shown that no hazardous quantity of such inflammable fluid will drain into any designated fire zone after shutting-off has been accomplished.

(b) Adequate provisions shall be made to guard against inadvertent operation of the shut-off means and to make it possible for the crew to reopen the shut-off means after it has once been closed.

[Amdt. 04-1, 11 F. R. 11351]

§ 4b.654 *Lines and fittings.* All lines and fittings for same located in designated fire zones which carry inflammable fluids or gases and which are under pressure or which attach directly to the engine or are subject to relative motion between components, exclusive of those lines and fittings forming an integral part of the engine, shall be flexible, fire-resistant lines with fire-resistant end fittings of the permanently attached, detachable, or other approved types. Lines and fittings which are not subject to pressure or to relative motion between components shall be of fire-resistant materials.

[Amdt. 04-1, 11 F. R. 11351, as amended by Amdt. 04b-7, 12 F. R. 5960]

§ 4b.654-1 *Fire-resistant aircraft material (CAA rules which apply to § 4b.654).* See §§ 4b.448-1, 4b.448-2, 4b.448-3.

[13 F. R. 7729]

§ 4b.655 *Vent and drain lines.* All vent and drain lines and fittings for same located in designated fire zones and which carry inflammable fluids or gases shall comply with the provisions of § 4b.654, if the Administrator finds that rupture or breakage of a particular drain or vent line may result in a fire hazard.

[Amdt. 04-1, 11 F. R. 11351]

FIRE EXTINGUISHER SYSTEMS

§ 4b.661 *General.* (a) Unless it can be demonstrated that equivalent protection against destruction of the airplane in case of fire is provided by the use of fireproof materials in the nacelle and other components which would be subjected to flame, fire extinguishing systems shall be provided to serve all designated fire zones except in the case of an engine power section which is completely isolated from the engine accessory section by a fireproof diaphragm complying with the provisions of § 4b.622.

(b) The fire extinguishing system, the quantity of extinguishing agent, and the rate of discharge shall be such as to provide two adequate discharges. It shall be possible to direct both discharges to any main engine installation. Individual "one-shot" systems shall be acceptable in the case of auxiliary power units, fuel-burning heaters, and other combustion equipment.

(c) Materials in the fire extinguishing system shall not react chemically with the extinguishing agent so as to constitute a hazard.

[Amdt. 04-1, 11 F. R. 11351, as amended by Amdt. 04b-7, 12 F. R. 5960]

§ 4b.662 *Fire extinguishing agents.* Extinguishing agents employed shall be methyl bromide, carbon dioxide, or any other agent which has been demonstrated to provide equivalent extinguishing action. If methyl bromide or any other toxic extinguishing agent is employed, provisions shall be made to prevent the entrance of harmful concentration of fluid or fluid vapors into any personnel compartments either due to leakage during normal operation of the airplane or as a result of discharging the fire extinguisher on the ground or in flight when a defect exists in the extinguisher system. If a methyl bromide system is provided, the containers shall be charged with dry agent and shall be sealed by the fire extinguisher manufacturer or any other party employing satisfactory recharging equipment. If carbon dioxide is used, it shall not be possible to discharge sufficient gas into personnel compartments to constitute a hazard from the standpoint of suffocation of the occupants.

§ 4b.663 *Extinguishing agent container pressure relief.* Extinguisher agent containers shall be provided with a pressure relief to prevent bursting of the container due to excessive internal pressures. The discharge line from the relief connection shall terminate outside the airplane in a location convenient for inspection on the ground. An indicator shall be provided at the discharge end of the line to provide a visual indication when the container has discharged.

§ 4b.664 *Extinguishing agent container compartment temperature.* Precautions shall be taken to assure that the extinguishing agent containers are installed in a location where reasonable temperatures can be maintained for effective use of the extinguisher system.

§ 4b.665 *Fire extinguishing system materials.* All components of fire extinguishing systems located in designated fire zones shall be constructed of fireproof materials, except for connections which are subject to relative motion between components of the airplane, in which case they shall be of flexible fire-resistant construction so located as to minimize the possibility of failure.

[Amdt. 04-1, 11 F. R. 11351]

§ 4b.665-1 *Fire-resistant aircraft material (CAA rules which apply to § 4b.665).* See § 4b.448-3.

[13 F. R. 7729]

FIRE DETECTORS

§ 4b.671 *General.* Quick acting fire detectors shall be provided in all designated fire zones and shall be sufficient in number and location to assure the detection of fire which may occur in such zones.

§ 4b.672 *Fire detectors.* Fire detectors shall be constructed and installed in such a manner as to assure their ability to resist without failure all vibration, inertia, and other loads to which they may normally be subjected. Detectors shall be unaffected by exposure to oil, water, or other fluids or fumes which may be present.

[Amdt. 04-0, 11 F. R. 71, as amended by Amdt. 04b-1, 11 F. R. 11351]

PROTECTION OF OTHER AIRPLANE COMPONENTS

§ 4b.676 *Fire-resistant construction.* All airplane surfaces aft of the nacelles, in the region of one nacelle diameter on both sides of the nacelle center line, shall be constructed of fire-resistant material. This provision need not be applied to tail surfaces lying behind nacelles unless the dimensional configuration of the aircraft is such that the tail surfaces could be affected readily by heat, flames, or sparks emanating from a designated fire zone or engine compartment of any nacelle.

[Amdt. 04-1, 11 F. R. 11351]

§ 4b.676-1 *Fire-resistant aircraft material (CAA rules which apply to § 4b.676).* See § 4b.448-3.

[13 F. R. 7729]

SUBPART F—EQUIPMENT

§ 4b.681 *General.* The equipment specified in § 4b.691 is the minimum which shall be installed in the airplane. Such additional equipment as is necessary for a specific type of operation is specified in Part 40 entitled "Air Carrier Operating Certification," Part 41 entitled "Certification and Operation Rules for Scheduled Air Carrier Operations Outside the Continental Limits of the United States," and Part 61 entitled "Scheduled Air Carrier Rules," of this subchapter. All equipment essential to the safe operation of the airplane shall comply with §§ 4b.682–4b.831.

§ 4b.682 *Functional and installational requirements.* Each item of equipment shall be: (a) Of a type and design satisfactory to perform its intended function, (b) adequately labeled as to its identification, function, or operational limitations, or any combination of these, whichever is applicable, (c) properly installed, in accordance with specified limitations of the equipment, and (d) demonstrated to function satisfactorily in the airplane. Items of equipment for which type certification is required are outlined in Part 15 of this subchapter. Such items, when used in the airplane, shall have been certificated in accordance with the provisions of Part 15 of this subchapter (or previous regulations) and such other parts as may be applicable.

BASIC EQUIPMENT

§ 4b.691 *Required basic equipment.* Paragraphs (a) to (c) show the required basic equipment items necessary for type and airworthiness certification of the airplane:

(a) *Flight and navigation instruments.* (See §§ 4b.701–4b.706.)

(1) Air speed indicating system with heated pitot tube or equivalent means of preventing malfunctioning due to icing. (See §§ 4b.696 and 4b.703.)

(2) Altimeter (sensitive). (See § 4b.703.)

(3) Clock (sweep second).

(4) Free air temperature indicator.

(5) Gyroscopic bank and pitch indicator. (See § 4b.706.)

(6) Gyroscopic rate-of-turn indicator (with bank indicator). (See § 4b.706.)

(7) Gyroscopic direction indicator. (See § 4b.706.)

(8) Magnetic direction indicator. (See § 4b.704.)

(9) Rate-of-climb indicator (vertical speed). (See § 4b.703.)

(b) *Power-plant instruments.* (See §§ 4b.711–4b.716.)

(1) Carburetor air temperature indicator for each engine. (See § 4b.716.)

(2) Coolant temperature indicator for each liquid-cooled engine.

(3) Cylinder head temperature indicator for each air-cooled engine. (See § 4b.716.)

(4) Fuel pressure indicator for each pump-fed engine.

(5) For each engine not equipped with an automatic altitude mixture control:

(i) Fuel flowmeter indicator (see § 4b.714) or,

(ii) Fuel mixture indicator.

(6) Fuel quantity indicator for each fuel tank. (See § 4b.713.)

(7) Manifold pressure indicator for each engine.

(8) Oil pressure indicator for each engine.

(9) Oil quantity indicator for each oil tank when a transfer or oil reserve supply system is used. (See § 4b.715.)

(10) Oil temperature indicator for each engine.

(11) Tachometer for each engine.

(12) Fire warning indicators. (See §§ 4b.671 and 4b.672.)

(c) *Miscellaneous equipment.* (1) Approved seats for all occupants. (See § 4b.443.)

(2) Certificated safety belts for all occupants.

(3) A master switch arrangement for electrical circuits other than ignition.

(4) Adequate source(s) of electrical energy.

(5) Electrical protective devices.

(6) Radio communication system (two-way).

(7) Radio navigation system.

(8) Windshield wiper or equivalent for each pilot.

(9) Ignition switch for each and all engines. (See § 4b.633.)

(10) Portable fire extinguisher. (See § 4b.799.)

[Amdt. 04-0, 11 F. R. 71 as amended by Amdt. 04b-6, 12 F. R. 5750]

§ 4b.691-1 *Technical Standard Order TSO-C2a: "Airspeed Indicator (Pitot Static)" (CAA rules which apply to § 4b.691)*—(a) *Introduction.* Under section 601 of the Civil Aeronautics Act of 1938, as amended, and §§ 3.31, 3.655, 4a.31, 4a.535, 4b.41, 4b.691, 6.6, and 6.52 of this chapter, the Administrator of Civil Aeronautics is authorized to adopt standards for airspeed indicators intended for use in civil aircraft. In adopting these standards, consideration has been given to existing Government and industry standards for airspeed indicators.

(b) *Directive*—(1) *Provision.* The performance requirements for airspeed indicators, as set forth in sections 6 and 7 of SAE Specification AS-391A, Airspeed Indicator (pitot static) revised February 1, 1949,[1] stated below, are hereby established as minimum safety performance standards for airspeed indicators intended for use in civil aircraft:

1. *Purpose.* To specify minimum requirements for Pitot Static Pressure Type of Airspeed Indicators for use in aircraft, the operation of which may subject the instruments to the environmental conditions specified in Section 3.3.

2. *Scope.* This specification covers six types of instruments as follows:

Type I: 30–250 miles per hour range.
Type II: 40–300 miles per hour range.
Type III: 50–400 miles per hour range.
Type IV: 50–450 miles per hour range.
Type V: 50–700 miles per hour range.

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[1] Copies may be obtained from the Society of Automotive Engineers, 29 West 39th St., New York, N. Y.

Type VI: 50–425 knots range.

3. *General requirements.*

3.1 *Materials and workmanship.*

3.1.1 *Materials.* Materials shall be of a quality which experience and/or tests have demonstrated to be suitable and dependable for use in aircraft instruments.

3.1.2 *Workmanship.* Workmanship shall be consistent with high grade aircraft instrument manufacturing practice.

3.2 *Identification.* The following information shall be legibly and permanently marked on the instrument or attached thereto:

(a) Name of instrument (airspeed indicator).

(b) SAE Specification, AS 391A.

(c) Manufacturer's part number.

(d) Manufacturer's serial number or date of manufacture.

(e) Manufacturer's name or trademark.

(f) Range.

3.3 *Environmental conditions.* The following are established design requirements only. All tests shall be conducted as specified in sections 5, 6, and 7.

3.3.1 *Temperature.* When installed in accordance with the instrument manufacturer's instructions, the instrument shall function over the range of ambient temperatures from −30° C. to 50° C. and shall not be adversely affected by exposure to temperatures of −65° C. and 70° C.

3.3.2 *Humidity.* The instrument shall function and shall not be adversely affected when exposed to any relative humidity in the range from 0 to 95 percent at a temperature of approximately 32° C.

3.3.3 *Altitude.* The instrument shall function and shall not be adversely affected when subjected to a pressure and temperature range equivalent to −1,000 feet to 40,000 feet standard altitude, except as limited by the application of 3.3.1.

3.3.4 *Vibration.* When installed in accordance with the instrument manufacturer's instructions, the instrument shall function and shall not be adversely affected when subjected to vibrations of not more than 0.010 inch at a frequency from 500 to 3,000 cycles per minute [1] or of not more than 1.3 g. When specified by the purchaser for use in rotary wing aircraft, the frequency range shall be 150–3,000 cycles per minute.

3.4 *Magnetic effect.* The magnetic effect of the indicator shall not adversely affect the operation of other instruments installed in the same aircraft.

4. *Detail requirements.*

4.1 *Pressure equivalents.* These instruments shall be calibrated to indicate airspeed in accordance with the following pressure equivalents (tables I and II)

[1] It is understood that the unit shall withstand vibrations at higher frequencies, but the acceleration values need not exceed those shown above.

TABLE I—DIFFERENTIAL PRESSURES FOR AIRSPEEDS IN M. P. H.

[Water and mercury at 15° C.]

Airspeed m. p. h.	Differential pressure		
	Inches of water	Inches of mercury	Pounds per square inch
20	0.197	0.0145	0.0071
40	.788	.0581	.0284
50	1.231	.0907	.0444
60	1.774	.1307	.0640
70	2.416	.1780	.0872
80	3.158	.2327	.1140
90	4.000	.2948	.1444
100	4.942	.3642	.1784
120	7.130	.5254	.2573
140	9.726	.7167	.3510
160	12.736	.9385	.4577
180	16.167	1.191	.5835
200	20.025	1.476	.7227
210	22.117	1.630	.7982
240	29.054	2.141	1.049
250	31.592	2.328	1.140
270	37.014	2.728	1.336
300	46.033	3.392	1.661
330	56.15	4.138	2.026
360	67.42	4.968	2.433
400	84.32	6.214	3.043
450	108.66	8.007	3.922
500	136.87	10.086	4.940
550	169.31	12.476	6.110
600	206.40	15.210	7.449
650	248.62	18.321	8.973
700	296.50	21.849	10.701

TABLE II—DIFFERENTIAL PRESSURES FOR AIRSPEEDS IN KNOTS

[Water and mercury at 15° C.]

Airspeed knots	Differential pressure		
	Inches of water	Inches of mercury	Pounds per square inch
50	1.634	0.1204	0.0590
60	2.354	.1735	.0850
70	3.207	.2363	.1157
80	4.192	.3089	.1513
90	5.310	.3913	.1916
100	6.563	.4836	.2368
120	9.475	.6982	.3420
140	12.94	.9535	.4670
160	16.95	1.249	.6117
180	21.54	1.587	.7774
200	26.71	1.968	.9640
210	29.51	2.175	1.065
240	38.84	2.862	1.402
250	42.27	3.115	1.526
270	49.59	3.654	1.790
300	61.82	4.556	2.231
330	75.61	5.572	2.729
360	91.03	6.708	3.285
400	114.33	8.425	4.126
420	127.21	9.374	4.591

4.2 *Indicating method.* These airspeed instruments shall indicate by a means of a pointer moving over a fixed dial. Sensitive types shall have, in addition, an under dial visible through an aperture in the fixed dial for indicating hundreds of miles per hour. Clockwise pointer motion shall indicate increasing airspeed.

4.3 *Visibility.* The pointer and all dial markings shall be visible from any point within the frustum of a cone whose side makes an angle of not less than 30° with the perpendicular to the dial, and whose small diameter is the aperture of the instrument case. The distance between the dial and the cover glass shall be a practical minimum and shall not exceed 0.187 of an inch.

4.4 *Dial markings.*

4.4.1 *Finish.* Unless otherwise specified luminescent (self activating) material shall be applied to all major graduations, numerals and pointer.

4.4.2 *Graduations.* Minor graduations shall be used at intervals not to exceed 5 miles per hour, up to the 300 miles per hour mark. Major graduations shall be used to indicate every 10 miles per hour up to 300 miles per hour.

4.4.3 *Numerals.* Sufficient numerals shall be marked to positively and quickly identify all graduations. Numerals shall distinctly indicate the graduations to which each applies.

4.4.4 *Instrument name.* The word "Airspeed" shall be marked and may be the same finish as the numerals. The inscription "m. p. h." or "knots" shall appear on the dial.

4.5 *Limitation of pointer movements.* The pointer movement shall be limited by stops in the mechanism in such a way that the pointer will not be permitted to rotate more than 10 degrees beyond the last graduation on the dial. Stops may also be incorporated in the instrument mechanism to limit counterclockwise motion of the pointer.

4.6 *Back of case markings.* The back of the case, adjacent to the connections shall be marked as follows:

P—Pitot pressure connection.

S—Static pressure connection.

5. *Test conditions.*

5.1 *Atmospheric conditions.* Unless otherwise specified, all tests required by this specification shall be conducted at an atmospheric pressure of approximately 29.92 inches of mercury, and at an ambient temperature of approximately 22° C. When tests are made with the atmospheric pressure or the temperature substantially different from these values allowances shall be made for the variations from the specified conditions.

5.2 *Vibration (to minimize friction).* Unless otherwise specified, all tests for performance may be made with the instrument subjected to a vibration of 0.002 to 0.005 inch amplitude at a frequency of 1,500 to 2,000 cycles per minute. The term amplitude as used herein indicates the total displacement from positive maximum to negative maximum.

5.3 *Preconditioning.* No pressure shall be applied to the diaphragm or any actuating element of the instrument, nor shall the diaphragm or other actuating element be flexed or exercised for a period of 24 hours prior to the start of the tests of section 6.

5.4 *Vibration equipment.* Vibration equipment shall be used which will vibrate at any desired frequency between 500 and 3,000 cycles per minute and shall subject the instrument to vibration such that a point on the instrument case will describe, in a plane inclined 45° to the horizontal plane, a circle, the diameter of which is equal to the amplitude specified herein.

6. *Individual performance requirements.* All instruments shall be subjected to whatever tests the manufacturer deems necessary to demonstrate specific compliance with this specification including the following requirements where applicable.

6.1 *Scale error.* The instrument shall be tested for scale errors at the points of the scale indicated in table III. The tests shall be made by subjecting the instrument to the pressure specified to produce these readings, first with pressure increasing, then with pressure decreasing. With pressure increasing, the pressure shall be brought up to, but shall not exceed the pressure specified to give the desired reading. With pressure decreasing, the pressure shall be brought down to, but shall not fall below the pressure specified to give the desired reading. The errors at the test points shall not exceed the tolerances specified in table III.

6.2 *Friction.* The instrument shall be tested for friction at the test points indicated by an asterisk (*) in table III. The pressure shall be brought up to the desired reading and then held constant while two readings are taken: the first reading being taken before the instrument is vibrated, and the second one after the instrument is vibrated. The difference between any two readings shall not exceed the tolerance in table IV.

6.3 *Position.* A pressure equivalent to one quarter, one half and three quarters scale deflection shall be applied. The change in reading at each deflection produced by rotating the instrument from the vertical to the horizontal position, or 90 degrees to the right or left, while the instrument is vibrated shall not exceed the tolerance specified in table III.

6.4 *Leak.* With both the pitot pressure and static pressure connections simultaneously evacuated to 15 inches of mercury, the leakage shall not cause more than 0.4 inch of mercury pressure drop during a 10-second period. With the static pressure connection open, and pressure equivalent to full scale pointer deflection applied to the pitot pressure connection, the leakage shall not cause more than 1 m. p. h. decrease in indication during a one minute period.

7. *Qualification tests.* As many instruments as deemed necessary to demonstrate that all instruments will comply with the requirements of this section shall be tested in accordance with the manufacturer's recommendations:

7.1 *Low temperature.* The instrument shall be subjected to a temperature of −30° C. for a period of 3 hours. With the temperature held at −30° C. the instrument shall be tested for scale errors as described in paragraph 6.1. The errors at the test points shall not exceed the tolerances of table III by more than the amount specified in table IV.

7.2 *High temperature.* The instrument shall be subjected to a temperature of 50° C. for a period of 3 hours. With the temperature held at 50° C., the instrument shall be tested for scale errors as described in paragraph 6.1. The errors at the test points shall not exceed the tolerances of table III by more than the amount specified in table IV.

7.3 *Extreme temperature exposure.* The instrument shall, after alternate exposures to ambient temperatures of −65° C. and 70° C. for periods of 24 hours each and a delay of 3 hours at room temperature following completion of the exposure, meet the requirements of section 6.1. There shall be no evidence of damage as a result of exposure to the extreme temperatures specified herein.

7.4 *Vibration.* With a pressure applied, sufficient to give half scale deflection, the instrument shall be vibrated at 500 cycles per minute and describe a circle of 0.003–0.005 inch diameter. The frequency shall be slowly increased to 3,000 cycles per minute and then slowly decreased to 500 cycles per minute, to determine whether the natural frequency of the instrument is in this range. The drift of the pointer shall not exceed the tolerances of table IV and the instrument pointer shall not oscillate more than the tolerance specified in table IV. After three hours exposure to vibration amplitude as specified in section 3.4.4 and at natural frequency, if between 500 and 3,000 cycles per minute, otherwise at 2,000 cycles per minute, the instrument shall meet the requirements of section 6. No damage shall be evident after this test.

7.5 *Seasoning.* The instrument shall be subjected to one hundred applications of a differential pressure sufficient to produce approximately full scale deflection. Not less than one hour following this test the instrument shall be tested for scale errors as described in paragraph 6.1, except that the scale error test shall not exceed the tolerance specified in table III by more than the amount specified in table IV.

7.6 *Drift.* The instrument shall be subjected to a differential pressure sufficient to produce approximately ¾ scale deflection. After being subjected to a pressure for a period of one hour, the instrument shall be tested as described in paragraph 6.1 except scale errors shall be determined for increasing pressure only. The reading of the instrument shall not have increased by more than the amount specified in table IV.

7.7 *Low temperature exposure.* The instrument shall be subjected to a temperature of −65° C. for a period of 24 hours. With the temperature held at −65° C. the instrument shall function. In addition, after the temperature is raised to −30° C. and held for a period of 3 hours, the instrument shall meet the requirements of paragraph 7.1.

7.8 *Magnetic effect.* The magnetic effect of the instrument shall be determined in terms of the deflection of a free magnet, approximately 1½ inches long, in a magnetic field with a horizontal intensity of 0.18, plus or minus 0.01 gauss, when the indicator is held in various positions on an east-west line with its nearest part 5 inches from the center of the magnet. (An aircraft compass with the compensating magnets removed therefrom may be used as a free magnet for this test.) The maximum deflection of the magnet shall not exceed 1° for any pointer deflection.

7.9 *Humidity test.* The instrument shall be subjected to the extreme conditions specified in paragraph 3.4.2 for a period of 10 hours, after which it shall meet the requirements of section 6.

TABLE III—TOLERANCES

Test point	250 m.p.h.	300 m.p.h.	400–450 m.p.h.	700 m.p.h. 7 revs.	425 knots
40	2.5	2.5			
50	*2.5	*2.5	3	4.0	
60	2.0	2.0	*3	2.0	*2
70	2.0				
80	2.0	2.0	3	*2.0	
90	*2.0				
100	2.0	*2.0	*3	2.0	*2
120	2.0		3	2.0	
140	2.5	2.5	3		
150					3
160	*2.5	2.5	5	*2.5	
180	3.0	3.0	5		
200					*4
210	3.0	*4.0	*5	4	
240	3.0	4.0	5		
250	*3.0			*4	5
270		4.0	5		
300		*4.0	5	4	5
330			5		
350					5
360			5	4	
400			5	*4	5
425					5
450				4	
500				5	
550				6	
600				6	
650				*6	

*Reference: Section 6.2.

TABLE IV—TOLERANCES

Test	Reference paragraph	Miles per hour				
		250	300	400–450	700 (7 rev.)	425 knots
Friction	6.2	3.0	3.5	3.5	3.5	4.0
Position	6.3	2.0	2.5	2.5	2.5	3.0
Vibration:						
Ptr. oscillation	7.3	2.0	2.0	2.0	1.5	3.0
Ptr. change	7.3	2.0	2.0	2.0	2.5	3.0
Temperature	7.1, 7.2	3.5	3.5	5.0	3.5	4.0
Drift	7.5	1.5	1.5	1.5	2.5	2.0
Seasoning	7.4	2.0	2.0	2.0	2.5	3.0

(2) *Application.* (i) Airspeed indicators complying with the specifications appearing in this section are hereby approved for all aircraft. Airspeed indicators already approved by the Administrator may continue to be installed in aircraft.

(*a*) For which an application for original type certificate is made prior to the effective date of this section,

(*b*) The prototype of which is flown within 1 year after the effective date of this section, and

(*c*) The prototype of which is not flown within 1 year after the effective date of this section if due to causes beyond the applicant's control.

(ii) If an alteration involving a change in type or model of airspeed indicator is made within 9 months after the effective date of this section, previously approved types of airspeed indicators may be installed. However, in any such change made after the 9-month period, new types of airspeed indicators installed in aircraft used in instrument flight shall meet the specifications contained herein.

(c) *Specific instructions*—(1) *Marking.* In addition to the identification information required in the referenced specification, each airspeed indicator shall be permanently marked with the Technical Standard Order designation, CAA–TSO–C2a, to identify the airspeed indicator as meeting the requirements of this section in accordance with the manufacturers' statement of conformance outlined below. This identification will be accepted by the Civil Aeronautics Administration as evidence that the established minimum safety requirements for airspeed indicators have been met.

(2) *Data requirements.* None.

(3) *Effective date.* After March 1, 1949, specifications contained in this section will constitute the basis for Civil Aeronautics Administration approval of airspeed indicators for use in certificated aircraft used in instrument flight.

(4) *Deviations.* Requests for deviation from, or waiver of, the requirements of this section, which affect the basic airworthiness of the component, should be submitted for approval by the Chief, Aircraft Service, Office of Aviation Safety, Civil Aeronautics Administration. These requests should be addressed to the nearest Regional Office of the Civil Aeronautics Administration, Attention: Superintendent, Aircraft Branch.

(5) *Conformance.* (i) The manufacturer shall furnish to the Civil Aeronautics Administration, Aircraft Service, Attention: A–298, Washington 25, D. C., a written statement of conformance signed by a responsible official of his company, setting forth that the airspeed indicators to be produced by him meet the minimum safety requirements established in this section. Immediately thereafter, distribution of the airspeed indicators conforming with the terms of this section may be started and continued.

(ii) The prescribed identification on the airspeed indicator does not relieve the aircraft manufacturer or owner of responsibility for the proper application of the airspeed indicator in his aircraft, nor waive any of the requirements concerning type certification of the aircraft in accordance with existing Civil Air Regulations.

(iii) If complaints of nonconformance with the requirements of this section are brought to the attention of the Civil Aeronautics Administration, and investigation indicates that such complaints are justified, the Administrator will take appropriate action to restrict the use of the product involved.

(iv) Copies of this Technical Standard Order and other Technical Standard Orders may be obtained from the Civil Aeronautics Administration, Aviation Information Staff, Washington 25, D. C.

[Supp. 5, 14 F. R. 3365]

§ 4b.691–2 *Technical Standard Order TSO–C3a: "Turn-and-Bank Indicator" (CAA rules which apply to § 4b.691)*—(a) *Introduction.* (1) Turn-and-bank indicators are in the class of aircraft components which the Administrator of Civil Aeronautics is authorized to approve in accordance with Parts 3, 4a, 4b, and 6 of this subchapter.

(2) This Technical Standard Order is intended to serve as a criterion by which the product manufacturer can obtain Civil Aeronautics Administration approval of his turn-and-bank indicator.

(3) In the establishment of this Technical Standard Order, consideration has been given to existing Government and industry standards for turn-and-bank

indicators for the purpose of adopting the performance requirements of one of the recognized aeronautical standards as the minimum safety requirements for turn-and-bank indicators which are intended for use in civil aircraft. The specification of the Society of Automotive Engineers for turn-and-bank indicators contains such requirements.

(b) *Directive.*

(1) *Provision.* Pursuant to §§ 3.31, 3.668, 4a.31, 4a.535, 4a.550, 4b.41, and 4b.691 of the Civil Air Regulations, which authorize the Administrator to approve aircraft equipment, the performance requirements for turn-and-bank indicators as set forth in SAE Specification AS-395, Turn-and-Bank Indicator, dated July 1, 1947,[1] stated below, are hereby established as minimum safety requirements for turn-and-bank indicators which are intended for use in civil aircraft:

1. *Purpose.* To specify minimum requirements for turn and bank indicators for use in aircraft, the operation of which may subject the instruments to the environmental conditions specified in section 3.4.

2. *Scope.* This specification covers three basic types of instruments as follows:

Type I. Air driven.
Type II. DC operated.
Type III. AC operated.

3. *General requirements.*

3.1. *Materials and workmanship.*

3.1.1. *Materials.* Materials shall be of a quality which experience and/or tests have demonstrated to be suitable and dependable for use in aircraft instruments.

3.1.2. *Workmanship.* Workmanship shall be consistent with high grade aircraft instrument manufacturing practice.

3.2. *Radio interference.* The instrument shall not be the source of objectionable interference, under operating conditions at any frequencies used on aircraft, either by radiation or feed back, in radio sets installed in the same aircraft as the instrument.

3.3. *Identification.* The following information shall be legibly and permanently marked on the instrument or attached thereto:

(a) Name of instrument (Turn and bank indicator).
(b) SAE Specification, AS-395.
(c) Rating (nominal electric or vacuum, etc.).
(d) Manufacturer's part number.
(e) Manufacturer's serial number or date of manufacture.
(f) Manufacturer's name or trademark.

3.4. *Environmental conditions.* The following are established design criteria only. All tests shall be run as per sections 5, 6 and 7.

3.4.1. *Temperature.* When installed in accordance with the instrument manufacturer's instructions the instrument shall function over the range of ambient temperature from −30° C. to 50° C. and shall not be adversely affected by exposure to temperatures in the range of −65° C. to 70° C.

3.4.2. *Humidity.* The instrument shall function and shall not be adversely affected when exposed to a relative humidity of up to and including 95% at a temperature of approximately 32° C.

3.4.3. *Altitude.* The instrument shall function and shall not be adversely affected when subjected to a pressure and temperature range equivalent to −1,000 to 40,000 feet standard altitude except that the instrument temperature shall not be lower than −30° C.

3.4.4. *Vibration.* When installed in accordance with the instrument manufacturer's instructions the instruments shall function and not be adversely affected when subjected to vibrations of not more than 0.010 inch at a frequency from 500 to 3,000 cycles per minute or of not more than 1.3 g. When specified by the purchaser for use in rotary wing aircraft, the frequency range shall be 150–3,000 cycles per minute.

NOTE: It is understood that the unit shall withstand vibration at higher frequencies, but the acceleration values need not exceed those shown above.

4. *Detail requirements.*

4.1. *Indicating method.* Turns shall be indicated by means of a pointer, deflecting in direction of turn. Banks shall be indicated by means of a black ball, free to move in a curved transparent tube.

4.2. *Visibility.* Both bank and turn indications shall be visible from any point within the frustum of a cone whose side makes an angle of not less than 30 degrees with the perpendicular to the dial and whose small diameter is the aperture of the instrument case. The distance between the dial and the cover glass shall be a practical minimum and shall not exceed 0.187 inch.

4.3. *Dial markings.*

4.3.1. *Finish.* Unless otherwise specified, luminescent (self-activating) material shall be applied to all markings, pointer and the inclinometer backing.

4.3.2. *Letters.* Letters "L" and "R" shall be legibly marked on the dial.

4.3.3 *Instrument name.* The words "Turn and Bank" shall be marked and may be indicated in the same finish as the letters.

4.4. *Power variations.* The instrument shall properly function with a voltage and frequency variation of ±10% of the rated value (provided the a. c. voltage and frequency vary in the same direction) and/or ±30% of the rated vacuum pressure.

5. *Test conditions.*

5.1. *Atmospheric conditions.* Unless otherwise specified, all tests required by this specification shall be made at an atmospheric pressure of approximately 29.92 inches of mercury and at an ambient temperature of approximately 22° C. When tests are made with atmospheric pressure or temperature substantially different from these values allowance shall be made for the variation from the specified conditions.

5.2 *Vibration (to minimize friction).* Unless otherwise specified all test for performance may be made with the instrument subjected to a vibration of 0.002 to 0.005 inch amplitude at a frequency of 1,500 to 2,000 cycles per minute. The term amplitude as used herein indicates the total displacement from positive maximum to negative maximum.

5.3. *Vibration stand.* A vibration stand shall be used which will vibrate at any desired frequency between 500 and 3,000 cycles per minute and shall subject the instrument to vibration such that a point on the instrument case will describe in a plane inclined 45 degrees to the horizontal plane, a circle, the diameter of which is equal to the amplitude specified herein.

5.4. *Turntable.* A turntable which can be operated smoothly through the ranges specified herein shall be used for making calibration tests.

5.5. *Power conditions.* Unless otherwise specified all tests for performance shall be conducted at the power rating recommended by the manufacturer.

5.6. *Normal operation.* All instruments shall be operated at normal power for at least five minutes prior to conducting any tests (unless otherwise specified).

6. *Individual performance requirements.* All instruments or components of such shall be subjected to whatever tests the manufacturer deems necessary to demonstrate specific compliance with this specification including the following requirements where applicable.

6.1. *Bank indicator zero position.* With the instrument in normal position with the lower mounting holes on a horizontal line, the position of the ball shall be within [illegible] inch of the zero position.

6.2. *Bank indicator friction.* The ball shall move smoothly and without sticking throughout the full length of the tube.

6.3. *Bank indicator visibility.* With the ball in the extreme position at each end of the tube at least one half of it shall be visible from a point 12 inches directly in front of the zero mark.

6.4. *Bank indicator filling.* The instrument shall be rotated so that all the air in the tube is trapped in the expansion chamber. Then, with the plane of the dial vertical, the instrument shall be rotated to an angle of roll of 45°. With the expansion chamber end of the tube low, no part of the air bubble shall be visible from a point 12 inches directly in front of the bank indicator zero position.

6.5. *Turn indicator starting.*

6.5.1. *Type I requirements.* The gyro rotor shall start to rotate and continue to run on a suction not to exceed 50% of rated value. Rated instrument performance speed shall be reached within five minutes after normal rated suction is applied.

6.5.2. *Types II and III requirements.* The gyro rotor shall start to rotate and continue to operate at a speed sufficient for proper performance of the instrument on an applied voltage not to exceed 80% of the rated voltage. This speed shall be reached within five minutes after application of the voltage.

6.6. *Turn indicator sensitivity, room temperature.* Starting in normal position and operating under rated power, the instrument shall be rotated about the vertical axis at the rates specified in Table I. Deflections of the turn indicator pointer shall be of the magnitude shown in Table I. Pointer motion shall be smooth.

6.7. *Dielectric test (Types II and III only).* The insulation shall be subjected to a dielectric test with a R. M. S. voltage at a commercial frequency applied for a period of five seconds equivalent to five times normal circuit operating voltage. Except where circuits include components for which such a test would not be appropriate, then the test voltage shall be 1.25 times normal circuit operating voltage. The insulation resistance shall not be less than 20 megohms at that voltage.

7. *Qualification tests.* As many instruments as deemed necessary to demonstrate that all instruments will comply with the requirements of this section shall be tested in accordance with the manufacturer's recommendations.

7.1. *Case leakage.* (Type I only.) A differential pressure of 15 inches of mercury between the inside and outside of the case shall not result in a leakage greater than that which will cause a pressure drop of 0.4 inch of mercury in 10 seconds.

7.2. *Bank indicator damping (room temperature).* When the instrument is suddenly rotated from a position of 12 degrees bank through the vertical to 12 degrees opposite bank, the time for the ball to move from the bank indicator zero position to the rest position at the end of the tube shall be 0.2 second or more.

7.3. *Bank indicator damping (low temperature).* The instrument shall be exposed without operating to a temperature of −65 C., for one hour. Then the instrument shall be tested as specified in Paragraph 7.2 except that the instrument shall operate at a temperature of −30° C. The time for ball motion from the zero position of the bank indicator to the rest position at the end of the tube shall not exceed four seconds.

7.4. *Bank indicator leakage.* The exposure of the instrument to a temperature of 70° C. for two hours shall not cause appreciable

[1] Copies may be obtained from the Society of Automotive Engineers, 29 West 39th St., New York, N. Y.

change in the size of the air bubble at room temperature.

7.5. *Magnetic effect.* The magnetic effect of the indicator shall be determined in terms of the deflection of a free magnet, approximately 1½ inches long, in a magnetic field with a horizontal intensity of 0.18 (±0.01) gauss when the indicator is held in various positions on an east-west line with its nearest part 5 inches from the center of the magnet. An aircraft compass with the compensating magnets removed therefrom may be used as the free magnet for this test. This test shall be made first with the instrument not operating and then shall be repeated with the instrument in normal operation. The maximum deflection of the magnet shall not exceed 2 degrees for any pointer position.

7.6. *Turn indicator damping, room temperature.* The instrument operating under rated power in normal position, shall be rotated about the vertical axis at a rate which causes full scale pointer deflection. The turn shall be stopped suddenly and the pointer shall return to the zero mark without crossing it in not less than two nor more than four seconds.

7.7. *Turn indicator sensitivity, low temperature.* After exposure to temperature of −30 C. for three hours, without operating, the instrument while still at −30 C. shall meet the requirements of paragraph 6.6 except that pointer deflection shall be as indicated in Table II. The performance shall be checked within ten minutes after power is applied. When turning is stopped the pointer shall return smoothly to zero within 1/32 inch.

7.8. *Turn indicator sensitivity, high temperature.* The conditions of paragraph 6.6 shall also be met at a test temperature of 70 C.

7.9. *Vibration.* With the gyro operating under rated power the instrument shall be vibrated at 500 cycles per minute and describe a circle of 0.003 to 0.005 inch diameter. The frequency shall be slowly increased to 3,000 cycles per minute and then decreased to 500 cycles per minute, to determine whether the natural frequency of the instrument occurs in this range. At no time shall the pointer leave the zero position more than 1/32 inch, and the ball shall remain at zero within 1/16 inch. After three hours exposure to vibration amplitude as specified in section 3.4.4 and at the natural frequency of between 500 and 3,000 cycles per minute, otherwise at 2,000 cycles per minute, no damage shall be evident and the instrument shall meet the requirements of section 6.

7.10. *Humidity.* The instrument shall be operated under the extreme conditions specified in section 3.4.2 for a period of 10 hours after which it shall meet the requirements of section 6.

TURN INDICATOR SENSITIVITY

TABLE I

Reference: Paragraph 6.6:

Rate of turning (degrees per minute):	Deflection of pointer tip (inches)
0	0±.015
36	1/16±1/64
180	5/16±1/64
360	½±1/16
1,080	1±⅛

TABLE II

Reference: Paragraph 7.7:

Rate of turning:	Deflection of pointer tip (inches)
180°	5/16±1/16
360°	½±⅛

(2) *Application.* (i) Turn-and-bank indicators complying with the specifications appearing in this Technical Standard Order are hereby approved for all aircraft. Turn-and-bank indicators already approved by the Administrator may continue to be installed in aircraft,

(*a*) For which an application for original type certificate is made prior to the effective date of this order,

(*b*) The prototype of which is flown within 1 year after the effective date of this order, and

(*c*) The prototype of which is not flown within 1 year after the effective date of this order if due to causes beyond the applicant's control.

(ii) If a major change is made in the installation within 9 months after the effective date of this order involving a change in type or model of turn-and-bank indicator, previously approved types of turn-and-bank indicators may be installed. However, in any such change made after the 9-month period, new types of turn-and-bank indicators installed in aircraft used in instrument flight shall meet the specifications contained herein.

(c) *Specific instructions.*

(1) *Marking.* In addition to the identification information required in the referenced specification, each turn-and-bank indicator shall be permanently marked with the Technical Standard Order designation "CAA-TSO-C3" to identify the turn-and-bank indicator as meeting the requirements of this order in accordance with the manufacturer's statement of conformance outlined below. This identification will be accepted by the Civil Aeronautics Administration as evidence that the established minimum safety requirements for turn-and-bank indicators have been met.

(2) *Data requirements.* None.

(3) *Effective date.* After July 1, 1948, specifications contained in this Technical Standard Order will constitute the basis for Civil Aeronautics Administration approval of turn-and-bank indicators for use in certificated aircraft used in instrument flight.

(4) *Deviations.* Requests for deviation from, or waiver of, the requirements of this order, which affect the basic airworthiness of the component, should be submitted for approval by the Director, Aircraft and Components Service, Office of Safety Regulation, Civil Aeronautics Administration. These requests should be addressed to the nearest regional office of the Civil Aeronautics Administration, Attn: Superintendent, Aircraft and Components Branch.

(5) *Conformance.* (i) The manufacturer shall furnish to the CAA, Aircraft and Components Service, A-298, Washington 25, D. C., a written statement of conformance signed by a responsible official of his company, setting forth that the turn-and-bank indicator to be produced by him meets the minimum safety requirements established in this order. Immediately thereafter distribution of the turn-and-bank indicator conforming with the terms of this order may be started and continued.

(ii) The prescribed identification on the turn-and-bank indicator does not relieve the aircraft manufacturer or owner of responsibility for the proper application of the turn-and-bank indicator in his aircraft, nor waive any of the requirements concerning type certification of the aircraft in accordance with existing Civil Air Regulations.

(iii) If complaints of nonconformance with the requirements of this order are brought to the attention of the Civil Aeronautics Administration, and investigation indicates that such complaints are justified, the Administrator will take appropriate action to restrict the use of the product involved.

(iv) Copies of this Technical Standard Order and other Technical Standard Orders may be obtained from the Civil Aeronautics Administration, Aviation Information Staff, Washington 25, D. C.

[13 F. R. 3845, 7731]

§ 4b.691-3 *Technical Standard Order TSO-C4b: "Bank and Pitch Indicator (Stabilized Type) (Gyro Horizon, Attitude Gyro)" (CAA rules which apply to § 4b.691)*—(a) *Introduction.* Under section 601 of the Civil Aeronautics Act of 1938, as amended, and §§ 4a.31 and 4a.550 of this chapter, and §§ 4b.41 and 4b.691, the Administrator of Civil Aeronautics is authorized to adopt standards for bank and pitch indicators intended for use in civil aircraft. In adopting these standards, consideration has been given to existing Government and industry standards for bank and pitch indicators.

(b) *Directive*—(1) *Provision.* The performance requirements for bank and pitch indicators, as set forth in sections 6 and 7 of SAE Specification AS-396 Bank and Pitch Indicator, dated August 1, 1947,[1] stated below, with the exceptions hereinafter noted, are hereby established as minimum safety performance standards for bank and pitch indicators intended for use in civil aircraft:

1. *Purpose.* To specify minimum requirements for gyroscopically stabilized bank and pitch indicators for use in aircraft, the operation of which may subject the instrument to the environmental conditions specified in section 3.4.

2. *Scope.* This specification covers two basic types as follows:

Type I. Having limited freedom of operation.

Type II. Having unlimited freedom of operation.

3. *General requirements.*

3.1. *Material and workmanship.*

3.1.1. *Materials.* Materials shall be of a quality which experience and/or tests have demonstrated to be suitable and dependable for use in aircraft instruments.

3.1.2. *Workmanship.* Workmanship shall be consistent with high-grade aircraft instrument manufacturing practice.

3.2. *Radio interference.* The instrument shall not be the source of objectionable interference, under operating conditions at any frequencies used on aircraft, either by radiation or feed-back, in radio sets installed in the same aircraft as the instrument.

3.3. *Identification.* The following information shall be legibly and permanently marked on the instrument or attached thereto:

(a) Name of instrument.

(b) S. A. E. Spec. AS 396.

(c) Rating (electrical, vacuum, etc.).

(d) Manufacturer's part number.

(e) Manufacturer's serial number or date of manufacture.

[1] Copies may be obtained from the Society of Automotive Engineers, 29 West 39th St., New York, N. Y.

(f) Manufacturer's name and/or trademark.

3.4. *Environmental conditions.* The following conditions have been established as design criteria only. Tests shall be conducted as specified in sections 5, 6 and 7.

3.4.1. *Temperature.* When installed in accordance with the instrument manufacturer's instructions the unit shall function over the range of ambient temperatures shown in column A below and shall not be adversely affected by exposure to the temperatures shown in column B below:

Instrument location	A	B
Heated areas (temperature controlled)	−30° to 50° C.	−65° to 70° C.
Unheated areas (temperature uncontrolled)	−55° to 70° C.	−65° to 70° C.

3.4.2. *Humidity.* The instrument shall function and not be adversely affected when exposed to a relative humidity up to and including 90 percent at a temperature of approximately +32° C.

3.4.3. *Altitude.* The instrument shall function and not be adversely affected when subjected to a pressure and temperature range equivalent to −1,000 to +40,000 feet standard altitude, except as limited by application of section 3.4.1.

3.4.4. *Vibration.* When installed in accordance with the instrument manufacturer's instructions, the units shall function and shall not be adversely affected when subject to the following vibrations:

Type of instrument mounting	Cycles per minute [1]	Amplitude [1]	Maximum acceleration
		Inch	
Shock mounted panel instruments	500-3000	0.005	0.8 g
Unshock mounted panel instruments	500-3000	.010	1.3 g
Structure mounted instruments	500-3000	.030	3.8 g

[1] It is understood that the unit shall withstand vibration at higher frequencies, but the acceleration value need not exceed those shown above.

When specified by the purchaser for use in rotary wing aircraft, the frequency range shall be 150–3,000 cycles per minute.

4. *Detail requirements.*

4.1. *Indicating method.* One of the following methods of indication shall be employed:

Method I—Horizontal bar which moves with respect to a fixed pitch reference marker. At the top of the dial, a pointer which moves angularly with respect to the bezel mask. Horizontal bar appears to move toward top of instrument face for dive and appears to rotate clockwise for left bank. Banking pointer appears to rotate clockwise for left bank.

Method II—Spherical dial which moves with respect to a fixed reference marker. The spherical dial appears to move down for dive and appears to rotate clockwise for left bank.

4.2. *Operating range.*

Type I—The useful operating range and the indicating range of the instrument shall be at least plus or minus 60 degrees in pitch and at least plus or minus 90 degrees in roll.

Type II—The useful operating range of the instrument shall be through 360 degrees in pitch and 360 degrees in roll. The range of indication in pitch for Method I indication shall be at least plus or minus 25 degrees and for Method II it shall be 360 degrees.

4.3. *Dial markings.*

4.3.1. *Increments.*

Type I—Right and left bank graduations shall be provided at intervals not to exceed 30 degrees between 0 and 90 degrees.

Type II—Bank graduations shall be as specified for Type I above. In addition, the sphere shall be graduated at intervals not to exceed 30 degrees from 0 to 90 degrees above and below the horizontal centerline.

4.3.2. *Visibility.* Index and dial markings shall be visible from any point within the frustum of a cone the side of which makes an angle of 30 degrees with the perpendicular to the dial and small diameter of which is the aperture of the instrument case.

4.3.3. *Finish.* Unless otherwise specified, luminescent material (self-activating) shall be applied to major graduations and numerals.

4.4. *Power variation.* All units shall properly function with ±15% variation in D. C. voltage and/or 10% variation in A. C. voltage and frequency, provided the A. C. voltage and frequency vary in the same direction.

4.5. *Turn error.* The pitch or bank indication error resulting from a coordinated turn of 180 degrees in 1 minute at a true airspeed of 180 m. p. m. shall not exceed 5 degrees.

4.6. *Gyro caging provisions.* Unless the gyro assembly has unrestricted freedom of operation in the pitch and roll axes, means shall be provided for caging and/or releveling the gyro. Means shall be provided to indicate when the gyro is caged, except when it is not possible to leave the gyro in caged condition.

4.7. *Power indication.* Means shall be provided to permit the operation of a device to indicate whether the instrument is receiving power.

5. *Test conditions.*

5.1. *Atmospheric conditions.* Unless otherwise specified, all tests required by this specification shall be made at an atmospheric pressure of approximately 29.92 inches of mercury and at an ambient temperature of approximately 220. When tests are made with the atmospheric pressure or the temperature substantially different from these values, allowance shall be made for the variation from the specified conditions.

5.2. *Vibration (to minimize friction).* Unless otherwise specified, all tests for performance may be made with the instrument subjected to a vibration of 0.002 to 0.005 inch amplitude at a frequency of 1,500 to 2,000 cycles per minute. The term amplitude as used herein indicates the total displacement from positive maximum to negative maximum.

5.3. *Power conditions.* Unless otherwise specified, all tests for performance shall be conducted at the power rating recommended by the manufacturer.

5.4. *Position.* Unless otherwise specified, all tests shall be made with the instrument in normal level position.

5.5. *Vibration stand.* For vibration tests a stand shall be used which will vibrate at any desired frequency between 500 and 8,000 cycles per minute and shall subject the instrument to vibration such that a point on the instrument case will describe, in a plane inclined 45 degrees to the horizontal plane, a circle, the diameter of which is equal to the amplitude specified herein.

6. *Individual performance requirements.* All instruments, or components of such, shall be subjected to whatever tests the manufacturer deems necessary to demonstrate specific compliance with this specification, including the following requirements where applicable:

6.1. *Starting.* The gyro rotor shall start to rotate and continue to run on application of 50 percent of rated suction for air operated instruments and 80 percent of rated voltage for electrically operated instruments. Rated instrument performance speed shall be reached within 3 minutes after normal rated power is applied.

6.2. *Roll, pitch and yaw.* When the gyro has erected and attained equilibrium speed, and the instrument has been oscillated through an angle of $\pm 7\frac{1}{2}$ degrees about each axis at a frequency of 5 to 7 cycles per minute for 10 minutes and then returned to level position, the alignment of the bank pointer (or vertical centerline of sphere) with their respective zero reference markers shall be within one degree.

6.3. *Climbing and diving.* With the instrument level, the gyro running at equilibrium speed and the gyro offset to the 20 degree climb indication, the time required for the gyro to erect to the 10 degree climb indication shall not exceed 8 minutes.

The time required to erect from the 10 degree climb indication to the zero pitch indication shall not exceed 12 minutes.

6.4. *Banking.* With the instrument level, the gyro running at equilibrium speed and the gyro offset to the 20 degree right bank indication, the time required for the gyro to erect to the 10 degree right bank indication shall not exceed 8 minutes.

The time required to erect from the 10 degree right bank indication to the zero bank indication (within 1 degree) shall not exceed 12 minutes.

The same tolerances shall apply when the gyro is offset to the 20 degree left bank indication and allowed to erect to the zero bank indication.

6.5. *Dielectric test.* The instrument shall be subject to a dielectric test with a R. M. S. voltage equivalent to five times operating voltage, but at a commercial frequency, applied between each ungrounded terminal and the instrument case for a period of 5 seconds. The breakdown resistance shall not be less than 20 megohms at that voltage (A. C. or D. C. as applicable).

7. *Qualification tests.* As many instruments as deemed necessary to demonstrate that all instruments will comply with the requirements of this section shall be tested in accordance with the manufacturer's recommendations.

7.1. *Low temperature operation.* After exposure to an ambient temperature of −30° C. for 5 hours, without operating, the instrument shall start upon application of rated power and at that temperature shall meet the requirements of section 6.2 except that the allowable alignment tolerances shall be 2 degrees.

7.2. *High temperature operation.* The requirements of section 7.1 shall apply except that the ambient temperature for exposure and test shall be 50° C.

7.3. *Extreme temperature exposure.* After 3 hours at room temperature following alternate exposures to ambient temperatures of −65° C. and 70° C. for 24 hours each, without operating, the instrument shall meet the requirements of section 6.2. No damage shall have resulted from the extreme temperature exposure specified herein.

7.4. *Magnetic effect.* The magnetic effect of the indicator shall be determined in terms of the deflection of a free magnet, approximately $1\frac{1}{2}$ inches long, in a magnetic field with a horizontal intensity of 0.18 (±0.01) gauss when the indicator is held in various positions on an east-west line with its nearest part 5 inches from the center of the magnet. This test shall first be made with the indicator not operating and then shall be repeated with the indicator in normal operation. The maximum deflection of the free magnet shall not exceed 5 degrees for any indicating or reference position.

7.5. *Humidity.* After operating under the extreme condition specified in section 3.4.2 for 10 hours, the instrument shall meet the requirements of section 6.2.

7.6. *Vibration.* The instrument(s) shall be subjected, while in normal operation, to vibration with an amplitude of 0.005 inch at frequencies from 1,000 to 3,000 cycles per minute in order to determine whether the natural frequency of the instrument(s) is in this frequency range. After 3 hours' exposure to vibration amplitudes as specified in section 3.4.4 and at the natural frequency, if between 1,000 and 3,000 c. p. m., otherwise at 2,000 c. p. m., the instrument(s) shall meet the requirements of section 6.1, 6.2 and 6.3. No damage shall be evident after this test.

(i) *Exceptions.* (*a*) Section 6.5 Dielectric Test. Last sentence: "The breakdown resistance shall not be less than 5 megohms at that voltage (A. C. or D. C. as applicable)."

(b) Section 7.5 Humidity. External filters may be used when necessary in the humidity test.

(2) *Application.* (i) Bank and pitch indicators complying with the specifications appearing in this order are hereby approved for all aircraft. Bank and pitch indicators already approved by the Administrator may continue to be installed in aircraft:

(*a*) For which an application for original type certificate is made prior to the effective date of this order,

(*b*) The prototype of which is flown within one year after the effective date of this order, and

(*c*) The prototype of which is not flown within one year after the effective date of this order if due to causes beyond the applicant's control.

(ii) If an alteration involving a change in type or model of bank and pitch indicator is made within nine months after the effective date of this order, previously approved types of bank and pitch indicators may be installed. However, in any such change made after the nine month period, new types of bank and pitch indicators installed in aircraft used in instrument flight shall meet the specifications contained herein.

(c) *Specific instructions*—(1) *Marking.* In addition to the identification information required in the referenced specification, each bank and pitch indicator shall be permanently marked with the Technical Standard Order designation, CAA-TSO-C4b, to identify the bank and pitch indicator as meeting the requirements of this order in accordance with the manufacturers' statement of conformance outlined in subparagraph (5) of this paragraph. This identification will be accepted by the Civil Aeronautics Administration as evidence that the established minimum safety requirements for bank and pitch indicators have been met.

(2) *Data requirements.* None.

(3) *Effective date.* After May 1, 1949, specifications contained in this order will constitute the basis for Civil Aeronautics Administration approval of bank and pitch indicators for use in certificated aircraft used in instrument flight.

(4) *Deviations.* Requests for deviation from, or waiver of, the requirements of this order, which affect the basic airworthiness of the component, should be submitted for approval by the Chief, Aircraft Service, Office of Aviation Safety, Civil Aeronautics Administration. These requests should be addressed to the nearest Regional Office of the Civil Aeronautics Administration, Attention: Superintendent, Aircraft Branch.

(5) *Conformance.* (i) The manufacturer shall furnish to the Civil Aeronautics Administration, Aircraft Service, Attention: A-298, Washington 25, D. C., a written statement of conformance signed by a responsible official of his company, setting forth that the bank and pitch indicator to be produced by him meets the minimum safety requirements established in this order. Immediately thereafter distribution of the bank and pitch indicator conforming with the terms of this order may be started and continued.

(ii) The prescribed identification on the bank and pitch indicator does not relieve the aircraft manufacturer or owner of responsibility for the proper application of the bank and pitch indicator in his aircraft, nor waive any of the requirements concerning type certification of the aircraft in accordance with existing Civil Air Regulations.

(iii) If complaints of nonconformance with the requirements of this order are brought to the attention of the Civil Aeronautics Administration, and investigation indicates that such complaints are justified, the Administrator will take appropriate action to restrict the use of the product involved.

(iv) Copies of this Technical Standard Order and other Technical Standard Orders may be obtained from the Civil Aeronautics Administration, Aviation Information Staff, Washington 25, D. C.

[Supp. 6, 14 F. R. 3461]

§ 4b.691-4 *Technical Standard Order TSO-C5b: "Direction Indicator, Non-Magnetic, Stabilized Type (Directional Gyro)" (CAA rules which apply to § 4b.691)*—(a) *Introduction.* Under section 601 of the Civil Aeronautics Act of 1938, as amended, and §§ 4a.31 and 4a.550 of this chapter, and §§ 4b.41 and 4b.691, the Administrator of Civil Aeronautics is authorized to adopt standards for non-magnetic direction indicators intended for use in civil aircraft. In adopting these standards, consideration has been given to existing Government and industry standards for non-magnetic direction indicators.

(b) *Directive*—(1) *Provision.* The performance requirements for non-magnetic direction indicators, as set forth in sections 6 and 7 of SAE Specification AS-397, Direction Indicator, Non-Magnetic, Stabilized Type (Directional Gyro) dated February 1, 1947[1], stated below, with the exceptions hereinafter noted, are hereby established as minimum safety performance standards for non-magnetic direction indicators intended for use in civil aircraft:

1. *Purpose.* To specify minimum requirements for non-magnetic gyroscopically stabilized direction indicators for use in aircraft.

2. *Scope.* This specification covers two basic types as follows:

Type I. Air operated.

Type II. Electrically operated.

3. *General requirements:*

3.1. *Material and workmanship.*

3.1.1. *Materials.* Materials shall be of a quality which experience and/or tests have demonstrated to be suitable and dependable for use in aircraft instruments.

3.1.2. *Workmanship.* Workmanship shall be consistent with high-grade aircraft instrument manufacturing practice.

3.2. *Radio interference.* The instrument shall not be the source of objectionable interference, under operating conditions at any frequencies used on aircraft, either by radiation or feed-back, in radio sets installed in the same aircraft as the instrument.

3.3. *Identification.* The following information shall be legibly and permanently marked on the instrument or attached thereto:

(a) Name of instrument.

(b) SAE Spec. AS 397.

(c) Rating (electrical, vacuum, etc.).

(d) Manufacturer's part number.

(e) Manufacturer's serial number or date of manufacture.

(f) Manufacturer's name and/or trade mark.

3.4. *Environmental conditions.*

3.4.1. *Temperature.* The instrument shall function over the temperature range −30° C. to +50° C. and shall not be adversely affected by exposure to temperatures in the range −65° C. to +70° C.

3.4.2. *Humidity.* The instrument shall function and not be adversely affected when exposed to a relative humidity up to and including 95 percent at a temperature of approximately 32° C.

3.4.3. *Altitude.* The instrument shall function and not be adversely affected when subjected to a pressure range equivalent to −1,000 feet to +40,000 feet standard altitude.

3.4.4. *Vibration.* The instrument shall function and not be adversely affected when subjected to vibration of 0.005 inch maximum amplitude at frequencies of 150-3,000 cycles per minute. The instrument shall withstand vibration, at higher frequencies, having acceleration values not to exceed 0.8 g.

4. *Detailed requirements.*

4.1. *Indicating method.* One of the following methods of indication shall be employed:

Method I. Horizontal drum dial with fixed lubber's line. Graduations move to the right for right turns.

Method II. Rotating vertical dial with fixed lubber's line at the top. Dial rotates counterclockwise for right turns.

Method III. Rotating pointer with fixed graduated dial. Pointer rotates clockwise for right turns.

4.2. *Operating limits.* The instrument shall indicate throughout the 360-degree scale range, during dives, climbs or banks up to at least 55 degrees displacement from level flight.

4.3. *Dial markings.*

4.3.1. *Increments.* Degree graduations shall be provided at intervals not to exceed 5 degrees with major graduations at 10, 20, 30, etc., degrees and with legible numerals at intervals not greater than 30 degrees throughout the scale range of 360 degrees. In the numerical marking the last digit (zero) shall be omitted. (Thus, 6 at 60 degrees, 9 at 90 degrees, etc.)

4.3.2. *Visibility.* Index and dial markings shall be visible from any point within the frustum of a cone the side of which makes an angle of 30 degrees with the perpendicular to the dial and the small diameter of which is the aperture of the instrument case. At least two numerals shall be simultaneously visible.

4.3.3. *Finish.* Unless otherwise specified, luminescent material shall be applied to major graduations and numerals.

4.4. *Course setting provisions.* A means shall be provided for manually setting the directional indicator dial (or pointer) indication to any heading desired.

4.5. *Gyro caging provisions.* Unless the gyro assembly has unrestricted freedom of operation in the pitch and roll axes, means shall be provided for caging and releveling the gyro should it become upset by operation beyond its limits. A conspicuous warning device shall indicate when the instrument is caged, except when it is not possible to leave the instrument in caged condition.

4.6. *Power indication.* Suitable internal or external means shall be provided for

[1] Copies may be obtained from the Society of Automotive Engineers, 29 West 39th St., New York, N. Y.

operating a device to indicate whether the instrument is receiving power.

5. *Test conditions.*

5.1. *Atmospheric conditions.* Unless otherwise specified, all tests required by this specication shall be made at an atmospheric pressure of approximately 29.92 inches of mercury and at an ambient temperature of approximately 22° C. When tests are made with the atmospheric pressure or the temperature substantially different from these values, allowance shall be made for the variation from the specified conditions.

5.2. *Vibration.* Unless otherwise specified, all tests for performance may be made with the instrument subjected to a vibration of 0.002 to 0.005 inch amplitude at a frequency of 1,500 to 2,000 cycles per minute. The term amplitude as used herein indicates the total displacement from positive maximum to negative maximum.

5.3. *Power conditions.* Unless otherwise specified, all tests for performance shall be conducted at the power rating recommended by the manufacturer.

6. *Individual performance tests.* All Type I and Type II instruments shall meet the requirements of the following individual tests where applicable.

6.1. *Type I requirements.*

6.1.1. *Starting.* The gyro rotor shall start to rotate and continue to run on a suction not to exceed 50 percent of rated value. Rated instrument performance speed shall be reached within two minutes after normal rated suction is applied.

6.1.2. *Roll, pitch and yaw.* The instrument shall be mounted on a test platform which is adjusted to oscillate in roll, pitch and yaw, with a total amplitude of 3 degrees about each axis, at a frequency of 5 to 7 oscillations per minute. With the platform level, and the gyro operating at equilibrium speed and uncaged, the dial (or pointer) reading shall be noted. The platform shall then be started in its roll, pitch and yaw movement. At the end of a ten minute period the oscillation shall be stopped, the platform realigned to its starting position, and the instrument dial (or pointer) reading noted. The amount of drift of the dial (or pointer) in either direction during the ten minute test period shall not exceed 4 degrees.

6.1.3. *Heading stability.* The instrument shall be mounted on a turn table, tilted 54 (±1) degrees from the vertical and the reading noted. The turn table shall be rotated one complete revolution about its vertical axis at 360 (±30) degrees per minute and the drift of the dial (or pointer) shall not exceed two degrees. The test shall be repeated rotating the turn table in the opposite direction.

6.2. *Type II requirements.*

6.2.1. *Starting.* The gyro rotor shall start to rotate and continue to operate at a speed sufficient for proper performance of the instrument on an applied voltage not to exceed 80 percent of the rated voltage. This speed shall be reached within two minutes after application of this voltage.

6.2.2. *Roll, pitch and yaw.* Same as for Type I.

6.2.3. *Heading stability.* Same as for Type I.

6.2.4. *Dielectric.* The instrument shall be subjected to a dielectric test with a R. M. S. voltage equivalent to five times operating voltage but at a commercial frequency applied between each terminal and the instrument case for a period of 5 seconds. The breakdown resistance shall not be less than 20 megohms at that voltage (A. C. or D. C. as applicable).

7. *Qualification tests.* As many instruments as appears necessary to demonstrate that all instruments will comply with the requirements of this section shall be subjected to the following additional tests:

7.1. *Low temperature operation.* The instrument shall be placed in a low temperature apparatus which will hold it in a level attitude. The instrument shall be subjected for a period of 2 hours to a temperature of −30° C. without operating. At the end of that period the instrument shall be started by application of rated power. The amount of drift of the dial (or pointer) in either direction during a 10-minute period shall not exceed 5 degrees.

7.2. *High temperature operation.* The foregoing test shall be repeated at a temperature of 50° C.

7.3. *Extreme temperature exposure.* The instrument shall first be subjected to the Roll, Pitch and Yaw Test specified in section 6 and shall meet the requirements of that test. The instrument shall then be subjected for a period of 24 hours to a temperature of −65° C. without operating. Upon completion of this exposure the instrument shall be returned to room temperature. After a period of not less than three hours the instrument shall be subjected for a period of 24 hours to a temperature of 70° C. without operating. Upon completion of this exposure the instrument shall be returned to room temperature. After a period of not less than three hours the instrument shall again be subjected to the Roll, Pitch and Yaw Test of section 6 and shall meet the requirements of that test. The instrument shall then be examined and shall not show evidence of damage as a result of exposure to the extreme temperatures specified herein.

7.4. *Magnetic effect.* The magnetic effect of the indicator shall be determined in terms of the deflection of a free magnet, approximately 1½ inches long, in a magnetic field with a horizontal intensity of 0.18 (±0.01) gauss when the indicator is held in various positions on an east-west line with its nearest part 5 inches from the center of the magnet. An aircraft compass with the compensating magnets removed therefrom may be used as the free magnet for this test. This test shall be made first with the instrument not operating and then shall be repeated with the instrument in normal operation. The maximum deflection of the magnet shall not exceed 2 degrees.

7.5. *Humidity.* The instrument shall be operated under the conditions specified in 3.4.2 for a period of 10 hours after which it shall meet the requirements of 6.1.2.

(i) *Exceptions.* (a) Section 6.2.4 Dielectric Test. Last sentence: "The breakdown resistance shall not be less than 5 megohms at that voltage (A. C. or D. C. as applicable)."

(b) Section 7.5 Humidity. External filters may be used when necessary in the humidity test.

(2) *Application.* (i) Non-magnetic direction indicators complying with the specifications appearing in this order are hereby approved for all aircraft. Non-magnetic direction indicators already approved by the Administrator may continue to be installed in aircraft:

(*a*) For which an application for original type certificate is made prior to the effective date of this order.

(*b*) The prototype of which is flown within one year after the effective date of this order, and

(*c*) The prototype of which is not flown within one year after the effective date of this order if due to causes beyond the applicant's control.

(ii) If an alteration involving a change in type or model of non-magnetic direction indicator is made within nine months after the effective date of this order, previously approved types of non-magnetic direction indicators may be installed. However, in any such change made after the nine month period, new types of non-magnetic direction indicators installed in aircraft used in instrument flight shall meet the specifications contained herein.

(c) *Specific instructions*—(1) *Marking.* In addition to the identification information required in the referenced specification, each non-magnetic direction indicator shall be permanently marked with the Technical Standard Order designation, CAA-TSO-C5b, to identify the non-magnetic direction indicator as meeting the requirements of this order in accordance with the manufacturers' statement of conformance outlined in subparagraph (5) of this paragraph. This identification will be accepted by the Civil Aeronautics Administration as evidence that the established minimum safety requirements for non-magnetic direction indicators have been met.

(2) *Data requirements.* None.

(3) *Effective date.* After May 1, 1949, specifications contained in this order will constitute the basis for Civil Aeronautics Administration approval of non-magnetic direction indicators for use in certificated aircraft used in instrument flight.

(4) *Deviations.* Requests for deviation from, or waiver of, the requirements of this order, which affect the basic airworthiness of the component, should be submitted for approval by the Chief, Aircraft Service, Office of Aviation Safety, Civil Aeronautics Administration. These requests should be addressed to the nearest Regional Office of the Civil Aeronautics Administration, Attention: Superintendent, Aircraft Branch.

(5) *Conformance.* (i) The manufacturer shall furnish to the Civil Aeronautics Administration, Aircraft Service, Attention: A-298, Washington 25, D. C., a written statement of conformance signed by a responsible official of his company, setting forth that the non-magnetic direction indicator to be produced by him meets the minimum safety requirements established in this order. Immediately thereafter distribution of the non-magnetic direction indicator conforming with the terms of this order may be started and continued.

(ii) The prescribed identification on the non-magnetic direction indicator does not relieve the aircraft manufacturer or owner of responsibility for the proper application of the non-magnetic direction indicator in his aircraft, nor waive any of the requirements concerning type certification of the aircraft in accordance with existing Civil Air Regulations.

(iii) If complaints of nonconformance with the requirements of this order are brought to the attention of the Civil Aeronautics Administration, and investigation indicates that such complaints are justified, the Administrator will take appropriate action to restrict the use of the product involved.

(iv) Copies of this Technical Standard Order and other Technical Standard Orders may be obtained from the Civil Aeronautics Administration, Aviation Information Staff, Washington 25, D. C.

[Supp. 6, 14 F. R. 3463]

§ 4b.691-5 *Technical Standard Order TSO-C6b: "Direction Indicator, Magnetic (Stabilized Type) (Stabilized Mag-*

netic Compass)" (CAA rules which apply to § 4b.691—(a) *Introduction.* Under section 601 of the Civil Aeronautics Act of 1938, as amended, and §§ 4a.31 and 4a.550 of this chapter, and §§ 4b.41 and 4b.691, the Administrator of Civil Aeronautics is authorized to adopt standards for stabilized magnetic direction indicators intended for use in civil aircraft. In adopting these standards, consideration has been given to existing Government and industry standards for stabilized magnetic direction indicators.

(b) *Directive*—(1) *Provision.* The performance requirements for stabilized magnetic direction indicators, as set forth in sections 6 and 7 of SAE Specification AS-399, Direction Indicator, Magnetic (Stabilized Type) dated August 1, 1947,[1] stated below, with the exceptions hereinafter noted, are hereby established as minimum safety performance standards for stabilized magnetic direction indicators intended for use in civil arcraft:

1. *Purpose.* To specify minimum requirements for gyroscopically stabilized (or integrated) magnetic direction indicators for use in aircraft, the operation of which may subject the instrument to the environmental conditions specified in section 3.4.

2. *Scope.* This specification covers minimum requirements for gyroscopically stabilized (or integrated) magnetic direction indicators for use in aircraft.

3. *General requirements.*

3.1. *Material and workmanship.*

3.1.1. *Materials.* Materials shall be of a quality which experience and/or tests have demonstrated to be suitable and dependable for use in aircraft instruments.

3.1.2. *Workmanship.* Workmanship shall be consistent with high-grade aircraft instrument manufacturing practice.

3.2. *Radio interference.* The instrument shall not be the source of objectionable interference, under operating conditions at any frequencies used on aircraft, either by radiation or feed-back, in radio sets installed in the same aircraft as the instrument.

3.3. *Identification.* The following information shall be legibly and permanently marked on each unit or attached thereto:

(a) Name of instrument.
(b) S. A. E. Spec. AS 399.
(c) Rating (electrical, vacuum, etc.).
(d) Manufacturer's part number.
(e) Manufacturer's serial number or date of manufacture.
(f) Manufacturer's name and/or trademark.

3.4. *Environmental conditions.* The following conditions have been established as design criteria only. Tests shall be conducted as specified in sections 5, 6 and 7.

3.4.1. *Temperature.* When installed in accordance with the instrument manufacturer's instructions the unit shall function over the range of ambient temperatures shown in column A below and shall not be adversely affected by exposure to the temperatures shown in column B below:

Instrument location	A	B
Heated areas (temperature controlled)	−30° to 50° C.	−65° to 70° C.
Unheated areas (temperature uncontrolled)	−55° to 70° C.	−65° to 70° C.

3.4.2. *Humidity.* The instrument shall function and not be adversely affected when exposed to a relative humidity up to and including 95% at a temperature of approximately 32° C.

3.4.3. *Altitude.* The instrument shall function and not be adversely affected when subjected to a pressure and temperature range equivalent to −1,000 to +40,000 feet standard altitude, except as limited by application of section 3.4.1.

3.4.4. *Vibration.* When installed in accordance with the instrument manufacturer's instructions, the units shall function and shall not be adversely affected when subject to the following vibrations:

Type of instrument mounting	Cycles per minute [1]	Amplitude [1]	Maximum acceleration
		Inch	
Shock mounted panel instruments	500-3000	0.005	0.8 g
Unshock mounted panel instruments	500-3000	.010	1.3 g
Structure mounted instruments	500-3000	.030	3.8 g

[1] It is understood that the unit shall withstand vibration at higher frequencies, but the acceleration values need not exceed those shown above.

When specified by the purchaser for use in rotary wing aircraft, the frequency range shall be 150–3,000 cycles per minute.

4. *Detail requirements.*

4.1. *Indicating method.* One of the following methods of indication shall be employed:

Method I. Horizontal drum dial with fixed lubber's line. The graduations shall move to the right for right turns.

Method II. Rotating vertical dial with fixed lubber's line. Dial shall rotate counterclockwise for right turns.

Method III. Rotating pointer with fixed graduated dial. Pointer shall rotate clockwise for right turns. Dial position may be settable.

4.2. *Operating limits.* The instrument shall indicate magnetic heading throughout the 360 degree scale range, during dives, climbs or banks up to at least 60 degrees displacement from level flight.

4.3. *Dial markings.*

4.3.1. *Increments.* The indicators shall be provided with degree graduations at intervals not to exceed 5 degrees, with major graduations every 10 degrees and with numerals at intervals not greater than 30 degrees, except that the 0, 90, 180 and 270 degree positions shall be marked N, E, S and W respectively.

4.3.2. *Visibility.* Index and dial markings shall be visible from any point within the frustum of a cone the side of which makes an angle of 30 degrees with the perpendicular to the dial and the small diameter of which is the aperture of the instrument case. At least two numerals shall be simultaneously visible.

4.3.3. *Finish.* Unless otherwise specified, luminescent (self-activating) material shall be applied to major graduations, numerals and pointers.

4.4. *Power variation.* All units shall properly function with ±15% variation in D. C. voltage and/or ±10% variation in A. C. voltage and frequency, provided the A. C. voltage and frequency vary in the same direction.

4.5. *Compensation provisions.* Means shall if necessary, be provided for compensating for semi-circular deviation. Compensating effect shall not exceed 30 degrees in each direction for each axis when adjusted for maximum effect.

4.6. *Gyro caging provisions.* Unless the gyro assembly has unrestricted freedom of operation in the pitch and roll axes, means shall be provided for caging and/or releveling the gyro. Means shall be provided to indicate when the gyro is caged, except when it is not possible to leave the gyro in caged condition.

4.7. *Synchronizing provisions.* Automatic or manual means shall be provided to bring the indicated heading into alignment with the magnetic heading. If manual synchronization is required, an indication of alignment shall be provided.

4.8. *Power indication.* Means shall be provided to permit the operation of a device to indicate whether the instrument is receiving power.

5. *Test conditions.*

5.1. *Atmospheric conditions.* Unless otherwise specified, all tests required by this specification shall be made at an atmospheric pressure of approximately 29.92 inches of mercury and at an ambient temperature of approximately 22° C. When tests are made with the atmospheric pressure or the temperature substantially different from these values, allowance shall be made for the variation from the specified conditions.

5.2. *Vibration (to minimize friction).* Unless otherwise specified, all tests for performance may be made with the instrument subjected to a vibration of 0.002 to 0.005 inch amplitude at a frequency of 1,500 to 2,000 cycles per minute. The term amplitude as used herein indicates the total displacement from positive maximum to negative maximum.

5.3. *Power.* Unless otherwise specified, all tests for performance shall be conducted at a power rating recommended by the manufacturer.

5.4. *Magnetic field strength.* Unless otherwise specified, all tests required by this specification shall be made with a horizontal field strength of approximately 0.18 gauss and a vertical field strength of approximately 0.54 gauss, in the direction normal in the northern hemisphere. When tests are made with field strength values substantially different from these values, allowance shall be made for variations from the specified tolerances.

5.5. *Position.* Unless otherwise specified, all tests shall be made with indicators and transmitters in normal level position.

5.6. *Compensators.* Unless otherwise specified, all tests shall be made with magnetic compensators removed or adjusted to neutral position.

5.7. *Vibration stand.* For vibration tests a stand shall be used which will vibrate at any desired frequency between 500 and 3,000 cycles per minute and shall subject the instrument to vibration such that a point on the instrument case will describe, in a plane inclined 45 degrees to the horizontal plane, a circle, the diameter of which is equal to the amplitude specified herein.

6. *Individual performance requirements.* All instruments, or components of such, shall be subjected to whatever tests the manufacturer deems necessary to demonstrate specific compliance with this specification, including the following requirements where applicable.

6.1. *Starting.*

6.1.1. *Potential.* The gyro shall start to rotate and continue to run on application of 50 percent of rated suction for air operated instruments and 80 of rated voltage for electrically operated instruments.

6.1.2. *Operation interval.* Rated performance shall be obtained within 3 minutes after the application of rated power.

6.2. *Scale error.* When the magnetic-sensitive unit is placed on magnetic headings at 30 degree intervals, starting from North, the indicated headings shall correspond to actual magnetic headings within 4 degrees.

6.3. *Heeling.* When the instrument is tilted 10 degrees about the roll or pitch axis and rotated 360 degrees in azimuth in 30 degree increments, the indicated headings shall not differ from the indicated headings with the instrument in normal level position by more than 4 degrees. The instrument shall remain at each heading for 5 minutes before reading.

6.4. *Compensation.* With the instrument on N heading and the magnetic compensator

[1] Copies may be obtained from the Society of Automotive Engineers, 29 West 39th St., New York, N. Y.

adjusted for minimum effect, the scale error with compensator shall not differ from the scale error without compensator by more than 2 degrees. The range of adjustable compensation effect shall not exceed 30 degrees in each direction for each axis.

When the instrument is placed on any cardinal heading and the opposite axis compensator adjusted for maximum effect, the indicated heading shall not change more than 2 degrees.

6.5. *Dielectric.* The insulation shall be subjected to a dielectric test with an R. M. S. voltage at a commercial frequency applied for a period of five seconds equivalent to five times normal circuit operating voltage except where circuits include components for which such a test would be inappropriate the test voltage shall be 1.25 times normal circuit operating voltage. The insulation resistance shall not be less than 20 megohms at that voltage.

7. *Qualification tests.* As many instruments as deemed necessary to demonstrate that all instruments will comply with the requirements of this section shall be tested in accordance with the manufacturer's recommendations.

7.1. *Low temperature.* The instrument, or components, shall be subjected to the temperatures indicated in the following table in accordance with their location in the aircraft. After exposure to these temperatures for 5 hours, rated performance shall be obtained in 15 minutes after application of rated power using the magnetic field strength specified in section 5.4 except the field strength tolerance shall be ±20%.

Instrument location:	*Temperature*
Heated area (temperature controlled)	−30° C.
Unheated area (temperature uncontrolled)	−55° C.

7.2. *High temperature.* The requirements of section 7.1 shall apply except that the exposure temperatures shall be 50° C. for heated areas and 70° C. for unheated areas and rated performance shall be obtained in 3 minutes after application of rated power.

7.3. *Extreme temperature exposure.* The instrument, or components, shall, after alternate exposures to ambient temperatures of −65° C. and 70° C. for periods of 24 hours each and a delay of 3 hours at room temperature following completion of the exposure, meet the requirements of sections 6.1 and 6.2. There shall be no evidence of damage as a result of exposure to the extreme temperatures specified herein.

7.4. *Magnetic effect.* The magnetic effect of the indicator shall be determined in terms of the deflection of a free magnet, approximately 1½ inches long, in a magnetic field with a horizontal intensity of 0.18 (±0.01) gauss when the indicator is held in various positions on an east-west line with its nearest part 12 inches from the center of the magnet. This test shall first be made with the indicator not operating and then shall be repeated with the indicator in normal operation. The maximum deflection of the free magnet shall not exceed 5 degrees for any pointer or dial position.

7.5. *Humidity.* The instrument shall be operated under the extreme condition specified in section 3.4.2 for a period of 10 hours after which it shall meet the requirements of sections 6.1 and 6.2.

7.6. *Vibration.* The instrument(s) shall be subjected, while in normal operation, to vibration with an amplitude of 0.010 inch at frequencies from 1,000 to 3,000 cycles per minute in order to determine whether the natural frequency of the instrument(s) is in this frequency range. While the instrument is being vibrated, the maximum range of the indicator dial (or pointer) oscillation shall not exceed 2 degrees and the maximum difference in mean indicated heading with and without vibration shall not exceed 2 degrees. After 3 hours exposure to vibration amplitudes as specified in section 3.4.4 and at the natural frequency of between 1,000 and 3,000 c. p. m., otherwise at 2,000 c. p. m., the instrument(s) shall meet the requirements of section 6.1, 6.2 and 6.3. Those components normally intended for shock mounting shall be subjected to a vibration having only 0.005 inch amplitude. No damage shall be evident after this test.

7.7. *Field strength variation.* With transmitter at a total field of 0.57±0.02 gauss at a dip angle of 72 degrees ±1 degree and the compass at a null, the null shall not vary more than ±2 degrees when the dip angle is changed to 80 degrees ±1 degree.

7.8. *Turn error.* The scale error resulting from a coordinated turn of 180 degrees in one minute at a true air speed of 180 miles per hour shall be within 2 degrees 2 minutes after resumption of straight and level flight. The error shall have been obtained from a turn which was begun from an easterly heading.

(i) *Exceptions.* (a) Section 6.5 Dielectric Test. Last sentence: "The breakdown resistance shall not be less than 5 megohms at that voltage (A. C. or D. C. as applicable)."

(2) *Application.* (i) Stabilized magnetic direction indicators complying with the specifications appearing in this order are hereby approved for all aircraft. Stabilized magnetic direction indicators already approved by the Administrator may continue to be installed in aircraft:

(*a*) For which an application for original type certificate is made prior to the effective date of this order,

(*b*) The prototype of which is flown within one year after the effective date of this order, and

(*c*) The prototype of which is not flown within one year after the effective date of this order if due to causes beyond the applicant's control.

(ii) If an alteration involving a change in type or model of stabilized magnetic direction indicator is made within nine months after the effective date of this order, previously approved types of stabilized magnetic direction indicators may be installed. However, in any such change made after the nine month period, new types of stabilized magnetic direction indicators installed in aircraft used in instrument flight shall meet the specifications contained herein.

(c) *Specific instructions*—(1) *Marking.* In addition to the identification information required in the referenced specification, each stabilized magnetic direction indicator shall be permanently marked with the Technical Standard Order designation, CAA–TSO–C6b, to identify the stabilized magnetic direction indicator as meeting the requirements of this order in accordance with the manufacturers' statement of conformance outlined in subparagraph (5) of this paragraph. This identification will be accepted by the Civil Aeronautics Administration as evidence that the established minimum safety requirements for stabilized magnetic direction indicators have been met.

(2) *Data requirements.* None.

(3) *Effective date.* After May 1, 1949, specifications contained in this order will constitute the basis for Civil Aeronautics Administration approval of stabilized magnetic direction indicators for use in certificated aircraft used in instrument flight.

(4) *Deviations.* Requests for deviation from, or waiver of, the requirements of this order, which affect the basic airworthiness of the component, should be submitted for approval by the Chief, Aircraft Service, Office of Aviation Safety, Civil Aeronautics Administration. These requests should be addressed to the nearest Regional Office of the Civil Aeronautics Administration, Attention: Superintendent, Aircraft Branch.

(5) *Conformance.* (i) The manufacturer shall furnish to the Civil Aeronautics Administration, Aircraft Service, Attention: A–298, Washington 25, D. C., a written statement of conformance signed by a responsible official of his company, setting forth that the stabilized magnetic direction indicator to be produced by him meets the minimum safety requirements established in this order. Immediately thereafter distribution of the stabilized magnetic direction indicator conforming with the terms of this order may be started and continued.

(ii) The prescribed identification on the stabilized magnetic direction indicator does not relieve the aircraft manufacturer or owner of responsibility for the proper application of the stabilized magnetic direction indicator in his aircraft, nor waive any of the requirements concerning type certification of the aircraft in accordance with existing Civil Air Regulations.

(iii) If complaints of nonconformance with the requirements of this order are brought to the attention of the Civil Aeronautics Administration, and investigation indicates that such complaints are justified, the Administrator will take appropriate action to restrict the use of the product involved.

(iv) Copies of this Technical Standard Order and other Technical Standard Orders may be obtained from the Civil Aeronautics Administration, Aviation Information Staff, Washington 25, D. C.

[Supp. 6, 14 F. R. 3464]

§ 4b.691–6 *Technical Standard Order TSO–C7a: "Direction Indicator, Magnetic, Nonstabilized Type (Magnetic Compass)" (CAA rules which apply to § 4b.691)*—(a) *Introduction* (1) Nonstabilized magnetic direction indicators are in the class of aircraft components which the Administrator of Civil Aeronautics is authorized to approve in accordance with Parts 4a and 4b of this subchapter.

(2) This Technical Standard Order is intended to serve as a criterion by which the product manufacturer can obtain Civil Aeronautics Administration approval of his nonstabilized magnetic direction indicator.

(3) In the establishment of this Technical Standard Order, consideration has been given to existing Government and industry standards for nonstabilized magnetic direction indicators for the purpose of adopting the performance requirements of one of the recognized aeronautical standards as the minimum safety requirements for nonstabilized magnetic direction indicators which are intended for use in civil aircraft. The specification of the Society of Automotive Engineers for nonstabilized magnetic direction indicators contains such requirements.

(b) *Directive.*

(1) *Provision.* Pursuant to §§3.31, 3.655, 4a.31, 4a.535, 4b.41, and 4b.691 of this subchapter, which authorize the Administrator to approve aircraft equipment, the performance requirements for nonstabilized magnetic direction indicators as set forth in SAE Specification AS-398, Direction Indicator, Magnetic, Nonstabilized Type, dated July 1, 1947,[1] stated below, are hereby established as minimum safety requirements for nonstabilized magnetic direction indicators which are intended for use in civil aircraft:

1. *Purpose.* To specify minimum requirements for non-stabilized magnetic direction indicators for use in aircraft, the operation of which may subject the instrument to the environmental conditions specified in section 3.4.

2. *Scope.* This specification covers two basic types as follows:

Type I. Direct reading.

Type II. Remote indicating.

3. *General requirements.*

3.1. *Material and workmanship.*

3.1.1. *Materials.* Materials shall be of a quality which experience and/or tests have demonstrated to be suitable and dependable for use in aircraft instruments.

3.1.2. *Workmanship.* Workmanship shall be consistent with high-grade aircraft instrument manufacturing practice.

3.2. *Radio interference.* The instrument shall not be the source of objectionable interference, under operating conditions at any frequencies used on aircraft, either by radiation or feed-back, in radio sets installed in the same aircraft as the instrument.

3.3. *Identification.* The following information shall be legible and permanently marked on each unit or attached thereto:

(a) Name of instrument.

(b) SAE specification AS 398.

(c) Rating (electrical, vacuum, etc.).

(d) Manufacturer's part number.

(e) Manufacturer's serial number or date of manufacture.

(f) Manufacturer's name and/or trademark.

3.4. *Environmental conditions.* The following conditions have been established as design criteria only. Tests shall be conducted as specified in sections 5, 6 and 7.

3.4.1. *Temperature.* When installed in accordance with the instrument manufacturer's instructions, the instrument shall function over the range of ambient temperature indicated below and shall not be adversely affected by exposure to temperature in the range −65° C. to +70° C.

Type I indicator	−30° C. to +50° C.
Type II indicator	−30° C. to +50° C.
Type II transmitter	−55° C. to +70° C.

3.4.2. *Humidity.* The instrument shall function and not be adversely affected when exposed to a relative humidity up to and including 95% at a temperature of approximately 32° C.

3.4.3. *Altitude.* The instrument shall function and not be adversely affected when subjected to a pressure range equivalent to −1,000 to +40,000 feet standard altitude.

3.4.4. *Vibration.* When installed in accordance with the instrument manufacturer's instructions, the instrument shall function and shall not be adversely affected when subjected to the following vibration:

Unit	Cycles per minute	Amplitude	Maximum acceleration
		Inch	
Type I indicator	500-3000	0.010	1.3 g
Type II indicator	500-3000	.010	1.3 g
Type II transmitter	500-3000	.030	3.8 g

NOTE: It is understood that the instrument shall withstand vibration at higher frequencies, but the acceleration values need not exceed those shown above.

When specified by the purchaser for use in rotary wing aircraft the frequency range shall be 150–3,000 cycles per minute.

4. *Detail requirements.*

4.1. *Indicating method.* One of the following methods of indication shall be employed:

Method I. Horizontal drum dial with fixed lubber's line. Graduations move to the right for right turns.

Method II. Rotating vertical dial with fixed lubber's line. Dial rotates counterclockwise for right turns.

Method III. Rotating pointer with fixed graduated dial. Pointer rotates clockwise for right turns. Dial position may be settable.

4.2. *Operating limits.* During straight flight the instrument shall indicate magnetic headings, throughout the 360 degree scale range, during dives, climbs or banks up to at least 20 degrees displacement from level flight.

4.3. *Dial markings.*

4.3.1. *Increments.* The indicators shall be provided with degree graduations at intervals not to exceed 5 degrees, with major graduations every 10 degrees and with numerical markings at intervals not greater than 30 degrees, except that the 0, 90, 180, and 270 degree positions shall be marked N, E, S, and W respectively.

4.3.2. *Visibility.* Index and dial markings shall be visible from any point within the frustum of a cone the side of which makes an angle of 30 degrees with the perpendicular to the dial and the small diameter of which is the aperture of the instrument case. At least two numerals shall be simultaneously visible.

4.3.3. *Finish.* Unless otherwise specified, luminescent material (self activating) shall be applied to major graduations, numerals and pointers.

4.4. *Power variations.* All units shall properly function with ±15% variation in D. C. voltage and/or ±10% variation in A. C. voltage and frequency, provided the A. C. voltage and frequency vary in the same direction.

4.5. *Compensation provisions.* Means shall be provided for compensating for semi-circular deviation. Compensating effect shall be between 15 and 30 degrees in each direction for each axis when adjusted for maximum effect.

5. *Test conditions.*

5.1. *Atmospheric conditions.* Unless otherwise specified, all tests required by this specification shall be made at an atmospheric pressure of approximately 29.92 inches of mercury and at an ambient temperature of approximately 22° C. When tests are made with the atmospheric pressure or the temperature substantially different from these values, allowance shall be made for the variation from the specified conditions.

5.2. *Vibration (to minimize friction).* Unless otherwise specified all test for performance may be made with the instrument subjected to a vibration of 0.002 to 0.005 inch amplitude at a frequency of 1,500 to 2,000 cycles per minute. The term amplitude as used herein indicates the total displacement from positive maximum to negative maximum.

5.3. *Power.* Unless otherwise specified, all tests for performance shall be conducted at the power rating recommended by the manufacturer.

5.4. *Magnetic field strength.* Unless otherwise specified all tests required by this specification shall be made with a horizontal field strength of approximately 0.18 gauss and a vertical field strength of approximately 0.54 gauss, in the direction normal in the northern hemisphere. When tests are made with field strength values substantially different from these values, allowances shall be made for variations from the specified tolerances.

5.5. *Position.* Unless otherwise specified all tests shall be made with indicators and transmitters in normal level position.

5.6. *Compensators.* Unless otherwise specified all tests shall be made with compensators removed or adjusted to neutral position.

5.7. *Vibration stand.* For vibration tests a stand shall be used which will vibrate at any desired frequency between 500 and 3,000 cycles per minute and shall subject the instrument to vibration such that a point on the instrument case will describe, in a plane inclined 45 degrees to the horizontal plane, a circle, the diameter of which is equal to the amplitude specified herein.

6. *Individual performance requirements.* All instruments, or components of such, shall be subjected to whatever tests the manufacturer thereof deems necessary to demonstrate specific compliance with this specification including the following requirements where applicable.

6.1. *Leakage.* Liquid-filled indicators or transmitters shall not show evidence of leakage after having been placed in a bell jar and subjected to a pressure equivalent to 40,000 feet standard altitude for a period of 1 hour.

6.2. *Scale error.* When the magnetic-sensitive unit is placed on magnetic headings at 30 degree intervals starting from North the indicated headings shall correspond to actual magnetic headings within 4 degrees.

6.3. *Friction.* When the magnetic element has been deflected 5 degrees first to right and then to left, from its equilibrium position and then allowed to come to rest, the difference between the two indicator readings at rest shall not exceed 1 degree.

6.4. *Damping.* When the magnetic element has been deflected 30 degrees, first to the right and to the left, from its equilibrium position, the time required for the indicator dial (or pointer) to pass through the 25 degree angle toward the original indicated heading shall not exceed 5.0 seconds or be less than 1.0 second. The maximum overswing past the original indicated heading shall not exceed 15 degrees.

6.5. *Heeling error.* When the magnetic-sensitive unit is tilted 20 degrees from the normal level position and magnetic element shall be free to rotate through 360 degrees. When the unit is tilted 10 degrees the indicated heading shall not differ from the indicated heading with the magnetic-sensitive unit in normal level position by more than 4 degrees. The indicator dial (or pointer) shall still be visible as specified in section 4.3.2.

6.6. *Swirl.* When the magnetic-sensitive unit is tilted 20 degrees from normal and rotated in azimuth, at a rate of 30 degrees per second, through 360 degrees, stopping at N, S, E, and W indication, the overswing of the indicator dial (or pointer) at each of these points shall not exceed 6 degrees.

6.7. *Compensation.* With the magnetic-sensitive unit on N heading and the compensator adjusted for minimum effect, the scale error with the compensator shall not differ from the scale error without compensator by more than 2 degrees. The range of adjustable compensation effect shall be between 15 and 30 degrees in each direction for each axis.

When the magnetic-sensitive unit is placed on any cardinal heading and the opposite

[1] Copies may be obtained from the Society of Automotive Engineers, 29 West 39th St., New York, N. Y.

axis compensator adjusted for maximum effect the indicated heading shall not change more than 2 degrees.

6.8. *Dielectric.* The insulation shall be subjected to a dielectric test with an R. M. S. voltage at a commercial frequency applied for a period of five seconds equivalent to five times normal circuit operating voltage except where circuits include components for which such a test would be inappropriate the test voltage shall be 1.25 times normal circuit operating voltage. The insulation resistance shall not be less than 20 megohms at that voltage.

7. *Qualification tests.* As many instruments as deemed necessary to demonstrate that all instruments will comply with the requirements of this section shall be tested in accordance with the manufacturer's recommendations.

7.1. *Low temperature.* The instruments, or components, shall be subjected to the temperatures indicated in the following table in accordance with their location in the aircraft. After exposure to these temperatures for 5 hours, rated performance shall be obtained in 15 minutes after application of rated power using the magnetic field strength specified in section 5.4 except the field strength tolerance shall be ±20%.

Instrument location:	*Temperature*
Heated area (temperature controlled)	−30° C.
Unheated area (temperature uncontrolled)	- 55° C.

7.2. *High temperature.* The requirements of section 7.1 shall apply except that the exposure temperatures shall be 50° C. for heated areas and 70° C. for unheated areas and rated performance shall be obtained in 3 minutes after application of rated power.

7.3. *Extreme temperature exposure.* The instrument, or components, shall, after alternate exposures to ambient temperatures of −65° C. and 70° C. for periods of 24 hours each and a delay of 3 hours at room temperature following completion of the exposure, meet the requirements of section 6.1 and 6.2. There shall be no evidence of damage as a result of exposure to the extreme temperatures specified herein.

7.4. *Magnetic effect.* The magnetic effect of the Type II indicator shall be determined in terms of the deflection of a free magnet, approximately 1½ inches long, in a magnetic field with a horizontal intensity of 0.18 (±0.01) gauss when the indicator is held in various positions on an east-west line with its nearest part 5 inches from the center of the magnet. This test shall first be made with the indicator not operating and then shall be repeated with the indicator in normal operation. The maximum deflection of the free magnet shall not exceed 2 degrees for any pointer or dial position.

7.5. *Humidity.* The instrument shall be operated under the extreme conditions specified in section 3.4.2 for a period of 10 hours after which it shall meet the requirements of sections 6.2 and 6.3.

7.6. *Vibration.* The instrument(s) shall be subjected, while in normal operation to vibration with an amplitude of 0.010 inch at frequencies from 1,000 to 3,000 cycles per minute in order to determine whether the natural frequency of the instrument(s) is in this frequency range. While the instrument is being vibrated, the maximum range of the indicator dial (or pointer) oscillation shall not exceed 3 degrees, and the maximum difference in mean indicated heading with and without vibration, shall not exceed 3 degrees. After 3 hours exposure to vibration amplitudes as specified in section 3.4.4 and at the natural frequency if between 1,000 and 3,000 c. p. m., otherwise at 2,000 c. p. m., the instrument(s) shall meet the requirements of section 6.1, 6.2 and 6.3. Those components normally intended for shock mounting shall be subjected to a vibration having only 0.005 inch amplitude. No damage shall be evident after this test.

(2) *Application.* (i) Nonstabilized magnetic direction indicators complying with the specifications appearing in this Technical Standard Order are hereby approved for all aircraft. Nonstabilized magnetic direction indicators already approved by the Administrator may continue to be installed in aircraft:

(*a*) For which an application for original type certificate is made prior to the effective date of this order.

(*b*) The prototype of which is flown within 1 year after the effective date of this order, and

(*c*) The prototype of which is not flown within 1 year after the effective date of this order if due to causes beyond the applicant's control.

(ii) If a major change is made in the installation within 9 months after the effective date of this order involving a change in type or model of nonstabilized magnet direction indic tor, previously approved types of nonstabilized magnetic direction indicators may be installed. However, in any such change made after the 9-month period, new types of nonstabilized magnetic direction indicators installed in aircraft used in instrument flight shall meet the specifications contained herein.

(c) *Specific instructions.*

(1) *Marking.* In addition to the identification information required in the referenced specification, each nonstabilized magnetic direction indicator shall be permanently marked with the Technical Standard Order designation "CAA-TSO-C7" to identify nonstabilized magnetic direction indicator as meeting the requirements of this order in accordance with the manufacturers' statement of conformance outlined below. This identification will be accepted by the Civil Aeronautics Administration as evidence that the established minimum safety requirements for nonstabilized magnetic direction indicators have been met.

(2) *Data requirements.* None.

(3) *Effective date.* After July 1, 1948, specifications contained in the Technical Standard Order will constitute the basis for Civil Aeronautics Administration approval of nonstabilized magnetic direction indicators for use in certificated aircraft used in instrument flight.

(4) *Deviations.* Requests for deviation from, or waiver of, the requirements of this order, which affect the basic airworthiness of the component, should be submitted for approval by the Director, Aircraft and Components Service, Office of Safety Regulation, Civil Aeronautics Administration. These requests should be addressed to the nearest regional office of the Civil Aeronautics Administration, Attn: Superintendent, Aircraft and Components Branch.

(5) *Conformance.* (i) The manufacturer shall furnish to the CAA, Aircraft and Components Service, A-298, Washington 25, D. C., a written statement of conformance signed by a responsible official of his company, setting forth that the nonstabilized magnetic direction indicator to be produced by him meets the minimum safety requirements established in this order. Immediately thereafter distribution of the nonstabilized magnetic direction indicator conforming with the terms of this order may be started and continued.

(ii) The prescribed identification on the nonstabilized magnetic direction indicator does not relieve the aircraft manufacturer or owner of responsibility for the proper application of the nonstabilized magnetic direction indicator in his aircraft, nor waive any of the requirements concerning type certification of the aircraft in accordance with existing Civil Air Regulations.

(iii) If complaints of nonconformance with the requirements of this order are brought to the attention of the Civil Aeronautics Administration, and investigation indicates that such complaints are justified, the Administrator will take appropriate action to restrict the use of the product involved.

(iv) Copies of this Technical Standard Order and other Technical Standard Orders may be obtained from the Civil Aeronautics Administration, Aviation Information Staff, Washington 25, D. C.

[13 F. R. 3852, 7731]

§ 4b.691-7 *Technical Standard Order TSO-C8a: "Climb Indicator, Pressure Actuated (Vertical Speed Indicator)" (CAA rules which apply to § 4b.691)*—(a) *Introduction.* (1) Climb indicators are in the class of aircraft components which the Administrator of Civil Aeronautics is authorized to approve in accordance with Parts 4a and 4b of this subchapter.

(2) This Technical Standard Order is intended to serve as a criterion by which the product manufacturer can obtain Civil Aeronautics Administration approval of his climb indicator.

(3) In the establishment of this Technical Standard Order, consideration has been given to existing Government and industry standards for climb indicators for the purpose of adopting the performance requirements of one of the recognized aeronautical standards as the minimum safety requirements for climb indicators which are intended for use in civil aircraft. The specification of the Society of Automotive Engineers for climb indicators contains such requirements.

(b) *Directive.*

(1) *Provision.* Pursuant to §§ 4a.31, 4a.535, 4a.550, 4b.41, and 4b.691 of this subchapter, which authorize the Administrator to approve aircraft equipment, the performance requirements for climb indicators as set forth in SAE Specification AS-394, Climb Indicator, dated August 1, 1947,[1] stated below, are hereby established as minimum safety requirements for climb indicators which are intended for use in civil aircraft:

1. *Purpose.* To specify minimum requirements for pressure actuated climb indicators for use in aircraft, the operation of which may subject the instrument to environmental conditions specified in section 3.4.

2. *Scope.* This specification covers three types as follows:

Type I. Range 0–2,000 feet per minute climb and descent.

Type II. Range 0–4,000 feet per minute climb and descent.

[1] Copies may be obtained from the Society of Automotive Engineers, 29 West 39th St., New York, N. Y.

Type III. Range 0–6,000 feet per minute climb and descent.

3. *General requirements.*

3.1. *Materials and workmanship.*

3.1.1. *Materials.* Materials shall be of a quality which experience or tests have demonstrated to be suitable and dependable for use in aircraft instruments.

3.1.2. *Workmanship.* Workmanship shall be consistent with high-grade aircraft instrument manufacturing practice.

3.2. *Identification.* The following information shall be legibly and permanently marked on the units or attached thereto:

(a) Name of instrument.

(b) SAE Spec. 394.

(c) Manufacturer's part number.

(d) Manufacturer's serial number or date of manufacture.

(e) Manufacturer's name and/or trademark.

3.3. *Environmental conditions.* The following conditions have been established as design criteria only. Tests shall be conducted as specified in sections 5, 6, and 7.

3.3.1. *Temperature.* When the instruments are mounted in accordance with manufacturer's instruments, they shall function over the range of ambient temperatures of −30° C. to 50° C. and shall not be adversely affected by exposure to temperatures of −65° C. to 70° C.

3.3.2. *Humidity.* The units shall function and not be adversely affected when exposed to a relative humidity up to and including 95 percent at approximately 32° C.

3.3.3. *Vibration.* When the instruments are mounted in accordance with manufacturer's instructions, they shall function and shall not be adversely affected when subjected to the following vibration.

Frequency: 500–3,000 cycles per minute.

Amplitude: 0.010 inch.

Maximum acceleration 0.8 g.

NOTE: It is understood that the units shall withstand vibration at higher frequencies but the acceleration values need not exceed that shown above.

When specified by the purchaser for use in rotary wing aircraft, the frequency range shall be 150–3,000 cycles per minute.

3.3.4. *Altitude.* The units shall function and not be adversely affected when subjected to a pressure and temperature range equivalent to an altitude range of −1,000 feet to +50,000 feet except that the instrument temperature shall not be lower than −30° C.

4. *General requirements.*

4.1. *Indicating method.* Ascent shall be indicated by a clockwise rotation of the pointer from the zero at the 9 o'clock position. Descent shall be indicated by a counterclockwise rotation. Stops shall be incorporated to limit the pointer movement to not more than 178 degrees in each direction from zero.

4.2. *Dial markings.*

4.2.1. *Increments.* Markings may be provided as follows:

Type I. Markings at 100 ft/min intervals with major graduations at 500 ft/min intervals.

Types II and III. Markings at 100 ft/min intervals up to 2,000 ft/min with major graduations at 500 ft/min intervals.

4.2.2. *Finish.* Unless otherwise specified, luminescent material (self-activating) shall be applied to the pointer, major graduations and numerals.

4.2.3. *Name.* Instrument name or function it measures may be legibly indicated in the same finish as applied to the major graduations and numerals.

4.2.4. *Visibility.* Pointer and dial markings shall be visible from any point within the frustrum of a cone, the side of which makes an angle of 30 degrees with the perpendicular to the dial and the small diameter of which is the aperture of the instrument case. The distance between the dial and the cover glass shall be a practical minimum and shall not exceed 0.187 of an inch.

4.3. *Zero setting system.* If means for manually setting the pointer at zero is provided, it shall not be accessible in flight.

5. *Test conditions.*

5.1. *Atmospheric conditions.* Unless otherwise specified, all tests required by this specification shall be made at an atmospheric pressure of approximately 29.92 inches of mercury and at a temperature of approximately 22° C. When tests are made with the atmospheric pressure or the temperature substantially different from these values, allowance shall be made for the variation from the specified condition.

5.2. *Vibration (to minimize friction).* Unless otherwise specified, all tests for performance may be made with the instrument subjected to a vibration of 0.002 to 0.005 inch amplitude at a frequency of 1,500 to 2,000 cycles per minute. The term amplitude as used herein indicates the total displacement from positive maximum to negative maximum.

5.3. *Vibration stand.* A vibration stand shall be used which will vibrate at any desired frequency between 500 and 3,000 cycles per minute and shall subject the instrument to vibration such that a point on the instrument case will describe, in a plane inclined 45 degrees to the horizontal, a circle, the diameter of which is equal to the amplitude specified herein.

6. *Individual performance requirements.* All instruments shall be subjected to whatever tests the manufacturer deems necessary to demonstrate specific compliance with this specification including the following requirements where applicable.

6.1. *Zero setting range.* The range of movement of the pointer by means of the zero adjustment shall not be less than 400 feet per minute for the "Up" and "Down" position.

6.2. *Calibration.* When subjected to the rates of change of pressure indicated in Table I for the altitude intervals shown, the errors shall not exceed the tolerances specified.

6.3. *Leak.* A suction of 15 inches of mercury and a pressure of 10 inches of mercury shall not change by more than 0.1 inch of mercury in 10 seconds at each condition.

6.4. *Position error.* The change in pointer indication with change in instrument position shall not exceed 50 feet per minute.

7. *Qualification tests.* As many instruments as deemed necessary, to demonstrate that all instruments will comply with the requirements of this section, shall be tested in accordance with the manufacturers' recommendations.

7.1. *Low temperature.* The instrument shall be exposed to a temperature of −30° C. for 3 hours and while at this temperature shall be subjected to the rates of change of pressure indicated in Table II for the altitude intervals shown. The errors shall not exceed the tolerances specified in Table II.

7.2. *Extreme temperature exposure.* The instrument shall, after alternate exposures to ambient temperatures of −65° C. and +70° C. for periods of 24 hours each and delay of 3 hours at room temperature following completion of the exposure, meet the requirements of sections 6.2 and 6.3. There shall be no evidence of damage as a result of exposure to the extreme temperatures specified herein.

7.3. *Vibration.* The instrument shall be vibrated at 500 cycles per minute so that a point on the case will describe a circle of 0.003–0.005 inch diameter. The frequency shall be slowly increased to 3,000 cycles per minute and then slowly decreased to 500 cycles per minute, to determine whether the natural frequency of the instrument is in this range. The drift of the pointer shall not exceed 50 feet per minute and it shall not oscillate more than 50 feet per minute. After three hours exposure to the vibration amplitude specified in section 3.3.3 and at the natural frequency (if between 500 and 3,000 cycles per minute) or at 2,000 cycles per minute the instrument shall meet the requirements of section 6. No damage shall be evident after this test.

7.4. *Lag.* The natural lag of the instrument when checked between the following points shall be between 6 and 15 seconds.

Type I. 1,800—200 feet per minute.

Types II and III. 2,000—200 feet per minute.

7.5. *Overpressure.* After subjecting the instrument to rates of 20,000 feet per minute climb and 30,000 feet per minute descent, the pointer shall return to its original indication within 100 feet per minute.

7.6. *Magnetic effect.* The magnetic effect of the instrument shall be determined in terms of the deflection of a free magnet, approximately 1½ inches long, in a magnetic field with a horizontal intensity of 0.18 ±0.01 gauss, when the indicator is held in various positions on an east-west line with its nearest part five inches from the center of the magnet. (An aircraft compass with the compensating magnets removed therefrom may be used as the free magnet for this test.) The maximum deflection of the magnet shall not exceed one degree for any pointer deflection.

TABLE I—CALIBRATION (REFERENCE SECTION 6)

TYPE I (RANGE 0–2,000 FEET PER MINUTE)

Standard altitude test interval (feet)	Test point ascent and descent (feet per minute)	Tolerance (feet per minute)
Between 2,000 and 4,000	500	35
	1,000	75
	1,500	150
Between 15,000 and 17,000	1,500	200
Between 28,000 and 30,000	1,500	200

TYPES II AND III (RANGES 0–4,000 AND 0–6,000 FEET PER MINUTE)

Standard altitude test interval (feet)	Test point ascent and descent (feet per minute)	Tolerance (feet per minute)
Between 2,000 and 4,000	500	100
	1,000	200
	2,000	300
	3,000	[1]300
	4,000	400
	5,000	500
Between 15,000 and 17,000	2,000	[1]300
	4,000	400
Between 28,000 and 30,000	2,000	[1]300
	4,000	400

[1] Maximum test point for Type II.

TABLE 2—LOW TEMPERATURE (REFERENCE SECTION 7.1)

TYPE I (RANGE 0–2,000 FEET PER MINUTE)

Standard altitude test interval (feet)	Test point ascent and descent (feet per minute)	Tolerance (feet per minute)
Between 2,000 and 4,000	1,500	200
Between 28,000 and 30,000	1,500	250

TYPES II–III (RANGE 0–4,000 AND 0–6,000 FEET PER MINUTE)

Standard altitude test interval (feet)	Test point ascent and descent (feet per minute)	Tolerance (feet per minute)
Between 2,000 and 4,000	2,000	[2]300
	4,000	400
Between 28,000 and 30,000	2,000	[2]300
	4,000	400

[2] Test point for Type II.

7.7. *Humidity.* After being subjected to the extreme conditions of section 3.3.2 for 10 hours, the instrument shall meet the requirements of section 6.

(2) *Application.* (i) Climb indicators complying with the specifications appearing in this Technical Standard Order are hereby approved for all aircraft. Climb indicators already approved by the Administrator may continue to be installed in aircraft:

(a) For which an application for original type certificate is made prior to the effective date of this order,

(b) The prototype of which is flown within 1 year after the effective date of this order, and

(c) The prototype of which is not flown within 1 year after the effective date of this order if due to causes beyond the applicant's control.

(ii) If a major change is made in the installation within 9 months after the effective date of this order involving a change in type or model of climb indicator, previously approved types of climb indicators may be installed. However, in any such change made after the 9-month period, new types of climb indicators installed in aircraft used in instrument flight shall meet the specifications contained herein.

(c) *Specific instructions.*

(1) *Marking.* In addition to the identification information required in the referenced specification, each climb indicator shall be permanently marked with the Technical Standard Order designation "CAA-TSO-C8" to identify the climb indicator as meeting the requirements of this order in accordahce with the manufacturer's statement of conformance outlined below. This identification will be accepted by the Civil Aeronautics Administration as evidence that the established minimum safety requirements for climb indicators have been met.

(2) *Data requirements.* None.

(3) *Effective date.* After July 1, 1948, specifications contained in this Technical Standard Order will constitute the basis for Civil Aeronautics Administration approval of climb indicators for use in certificated aircraft used in instrument flight.

(4) *Deviations.* Requests for deviation from or waiver of, the requirements of this order, which affect the basic airworthiness of the component, should be submitted for approval by the Director, Aircraft and Components Service, Office of Safety Regulation, Civil Aeronautics Administration. These requests should be addressed to the nearest regional office of the Civil Aeronautics Administration, Attn: Superintendent, Aircraft and Components Branch.

(5) *Conformance.* (i) The manufacturer shall furnish to the CAA, Aircraft and Components Service, A-298, Washington 25, D. C., a written statement of conformance signed by a responsible official of his company, setting forth that the climb indicator to be produced by him meets the minimum safety requirements established in this order. Immediately thereafter distribution of the climb indicator conforming with the terms of this order may be started and continued.

(ii) The prescribed identification on the climb indicator does not relieve the aircraft manufacturer or owner of responsibility for the proper application of the climb indicator in his aircraft, nor waive any of the requirements concerning type certification of the aircraft in accordance with existing Civil Air Regulations.

(iii) If complaints of nonconformance with the requirements of this order are brought to the attention of the Civil Aeronautics Administration, and investigation indicates that such complaints are justified, the Administrator will take appropriate action to restrict the use of the product involved.

(iv) Copies of this Technical Standard Order and other Technical Standard Orders may be obtained from the Civil Aeronautics Administration, Aviation Information Staff, Washington 25, D. C.

[13 F. R. 3853]

§ 4b.691-8 *Technical Standard Order TSO-C10a: "Altimeter, Pressure Actuated, Sensitive Type" (CAA rules which apply to § 4b.691)*—(a) *Introduction.* Under section 601 of the Civil Aeronautics Act of 1938, as amended, and §§ 3.31, 3.655, 4a.31, 4a.535, 4a.550, 4b.41, 4b.691, 6.6, and 6.52 of this chapter, the Administrator of Civil Aeronautics is authorized to adopt standards for sensitive altimeters intended for use in civil aircraft. In adopting these standards, consideration has been given to existing Government and industry standards for sensitive altimeters.

(b) *Directive* — (1) *Provision.* The performance requirements for sensitive altimeters, as set forth in sections 6 and 7 of SAE Specification AS-392A, Altimeters, Pressure Actuated, Sensitive Type revised February 1, 1949,[1] stated below, are hereby established as minimum safety performance standards for sensitive altimeters intended for use in civil aircraft:

1. *Purpose.* To specify minimum requirements for Pressure Actuated Sensitive Altimeters for use in aircraft, the operation of which may subject the instrument to the environmental conditions specified in section 3.3.

2. *Scope.* This Aeronautical Standard covers two basic types of instruments as follows:

Type I: Range 35,000 feet. Barometric pressure. Scale range at least 28.1-30.99 inches of mercury (946-1,049 millibars). May include markers working in conjunction with the barometric pressure scale to indicate pressure-altitude.

Type II: Range 50,000 feet. Barometric pressure. Scale range at least 28.1-30.99 inches of mercury (946-1,049 millibars). May include markers working in conjunction with the barometric pressure scale to indicate pressure-altitude.

3. *General requirements.*

3.1 *Materials and workmanship.*

3.1.1 *Materials.* Materials shall be of a quality which experience and/or tests have demonstrated to be suitable and dependable for use in aircraft instruments.

3.1.2 *Workmanship.* Workmanship shall be consistent with high-grade aircraft instrument manufacturing practice.

3.2 *Identification.* The following information shall be legibly and permanently marked on the units or attached thereto:

a. Name of instrument (altimeter).
b. SAE Specification AS 392A.
c. Manufacturer's part No.
d. Manufacturer's Serial No. or date of manufacture.
e. Manufacturer's name and/or trade mark.

3.3 *Environmental conditions.* The following conditions have been established as design requirements only. Tests shall be conducted as specified in sections 5, 6, 7.

3.3.1 *Temperature.* When installed in accordance with the instrument manufacturer's instructions, the instrument shall function over the range of ambient temperature of −30° C. to 50° C. and shall not be adversely affected by exposure to temperatures of −65° C. to 50° C.

3.3.2 *Humidity.* The units shall function and shall not be adversely affected when exposed to any relative humidity in the range from 0 to 95 percent at a temperature of approximately 32° C.

3.3.3 *Vibration.* When installed in accordance with the manufacturer's instructions, the units shall function and shall not be adversely affected when subjected to the following vibration.

Frequency: 500-3,000 cycles per minute.
Amplitude: 0.010 inch.
Maximum acceleration: 0.8 g.

NOTE: It is understood that the unit shall withstand vibration at higher frequencies but the acceleration value need not exceed that shown above.

When specified by the purchaser for use in rotary wing aircraft, the frequency range shall be 150-3,000 cycles per minute.

3.3.4 *Overpressure.* The units shall not be adversely affected by exposure to a pressure of 50 inches of mercury absolute.

3.4 *Magnetic effect.* The magnetic effect of the indicator shall not adversely affect the operation of the instruments installed in the same aircraft.

4. *Detail requirements.*

4.1 *Indicating method.* The following method of indication shall be employed. For indicating an ascent in altitude the sensitive pointer shall move in a clockwise direction completing one revolution (360°) for each 1,000 feet of altitude change. A means shall be provided for showing the multiples of 1,000 feet.

4.2 *Dial markings.*

4.2.1 *Increments.* Markings shall be provided at intervals not exceeding 20 feet of altitude with major increment markings at 100-foot intervals.

4.2.2 *Zero setting system.* A zero setting system shall be provided which will permit the altimeter to be set to show field elevation at any existing ground level barometric pressure. The zero setting system shall show the barometric pressure in inches of mercury or millibars at sea level throughout the range of at least 28.1 to 30.99 inches (946 to 1,049 millibars). A safety feature shall be provided which will prevent incorrect reading of the pressure scale when the zero setting mechanism exceeds its barometric pressure limits.

4.2.3 *Finish.* Unless otherwise specified, luminescent material (self-activating) shall be applied to the pointer(s), major graduations and numerals.

4.2.4 *Name.* The word "altitude" shall be marked on the dial and may be in the same finish as the numerals.

4.3 *Visibility.* Pointers and dial markings shall be visible from any point within the frustrum of a cone, the side of which makes an angle of 30° with the perpendicular to the dial and the small diameter of which is the aperture of the instrument case. The distance between the dial and the cover glass shall be a practical minimum and shall not exceed 0.25 of an inch.

5. *Test conditions.*

5.1 *Atmospheric conditions.* Unless otherwise specified, all tests required by this specification shall be conducted at an atmospheric pressure of approximately 29.92 inches of mercury and at a temperature of approximately 22° C. When tests are made with the atmospheric pressure or the temperature substantially different from the values, allowance shall be made for the variation from the specified condition.

5.2 *Vibration (to minimize friction).* Unless otherwise specified, all tests for performance may be made with the instrument

[1] Copies may be obtained from the Society of Automotive Engineers, 29 West 39th St., New York, N. Y.

subjected to a vibration of 0.002 to 0.005 inch amplitude at a frequency of 1,500 to 2,000 cycles per minute. The term amplitude, as used herein, indicates the total displacement from positive maximum to negative maximum.

5.3 *Vibration equipment.* Vibration equipment shall be used which will vibrate at any desired frequency between 500 and 3,000 cycles per minute and shall subject the instrument to vibration such that a point on the instrument case will describe, in a plane inclined 45° to the horizontal, a circle, the diameter of which is equal to the amplitude specified herein.

5.4 *Standard pressures.* The standard pressures used in calibrating the altimeters shall be as specified in tables III and IIIa.

6. *Individual performance requirements.* All instruments shall be subjected to whatever tests the manufacturer deems necessary to demonstrate specific compliance with this specification including the following requirements where applicable.

6.1 *Calibration.* For a period of not less than 12 hours prior to this test the altimeter shall not have been operated at other than the pressures specified in section 5.1. The barometric pressure scale shall be set at 29.92 inches of mercury and the scale error recorded. Without changing the setting, the altimeter shall be subjected successively to the pressures specified in table I. The reduction in pressure shall be made at a rate of approximately 3,000 feet per minute. The altimeter shall remain at the pressure corresponding to each test point for at least 1 minute but not more than 10 minutes before a reading is taken. The error at all test points shall not exceed the tolerances specified in table I. The movement of the pointers shall be free from backlash and irregular motion when the the pressure is changed uniformly.

6.2 *Case leak.* A pressure equivalent to 18,000 feet within the case shall not result in leakage exceeding the tolerance shown in table II during a period of 10 seconds.

6.3 *Position error.* The change in pointer indication with change in instrument position shall not exceed the tolerance specified in table II.

6.4 *Barometric scale error.* With the ambient pressure constant at 29.92 inches of mercury, various settings of the barometric pressure scale within its range shall cause the pointer to indicate the equivalent altitude as shown in table III within a tolerance of 25 feet.

7. *Qualification tests.* As many instruments as deemed necessary to demonstrate that all instruments will comply with the requirements of this section shall be tested in accordance with the manufacturers' recommendations.

7.1 *Low temperature.* The instrument shall be exposed to a temperature of −30° C. for 3 hours and while at this temperature shall meet the requirements of section 6.1 within the tolerances specified in table I.

7.2 *Extreme temperature exposure.* The instrument shall, after alternate exposures to ambient temperatures of −65° C. and 50° C. for periods of 24 hours each and a delay of 3 hours at room temperature following completion of the exposure, meet the requirements of section 6.1. There shall be no evidence of damage as a result of exposure to the extreme temperatures specified herein.

7.3 *Hysteresis.* Not more than 15 minutes after the altimeter has been first subjected to the pressure corresponding to the upper limit of the scale in section 6.1 the pressure shall be increased at a rate corresponding to a decrease in altitude of approximately 3,000 feet per minute until the pressure corresponding to 25,000 feet is reached. Within 10 seconds the instrument shall indicate within 100 feet of the test reading. The altimeter shall remain at this pressure for at least 5 minutes but not more than 15 minutes before the test reading is taken. After the reading has been taken, the pressure shall be further increased at the above rate until the pressure corresponding to 20,000 feet is reached. The altimeter shall remain at this pressure for at least 1 minute but not more than 10 minutes before the test reading is taken. After the reading has been taken, the pressure shall be further increased at the above rate until atmospheric pressure is reached. The reading of the altimeter at either of the two test points shall not differ from the reading of the altimeter for the corresponding altitude in the scale error test by more than the tolerance specified in table II.

7.4 *After effect.* Not more than 5 minutes after the completion of the hysteresis test, the pointers shall have returned to their original reading, corrected for any change in atmospheric pressure within the tolerance specified in table II.

7.5 *Vibration.* The instrument shall be vibrated at 500 cycles per minute so that a point on the case will describe a circle of 0.003–0.005 inch diameter. The frequency shall be slowly increased to 3,000 cycles per minute and then slowly decreased to 500 cycles per minute, to determine whether the natural frequency of the instrument is in this range. The drift of the pointer shall not exceed 50 feet and it shall not oscillate more than 20 feet. After three hours exposure to the vibration amplitude specified in section 3.3.3 and at the natural frequency (if between 500 and 3,000 cycles per minute) or at 2,000 cycles per minute the instrument shall meet the requirements of section 6. No damage shall be evident after this test.

7.6 *Magnetic effects.* The magnetic effect of the altimeter shall be determined in terms of the deflection of a free magnet approximately 1½ inches long in a magnetic field with a horizontal intensity of 0.18 ± 0.01 gauss, when the indicator is held in various positions on an east-west line with its nearest part 5 inches from the center of the magnet. (An aircraft compass with the compensating magnets removed therefrom may be used as the free magnet for this test.) The maximum deflection of the magnet shall not exceed 1° for any pointer deflection.

7.7 *Humidity.* The instrument shall function and not be adversely affected when exposed to the extreme condition specified in paragraph 3.3.2 for a period of 10 hours.

7.8 *Overpressure.* After being subjected momentarily to an absolute pressure of 50 inches of mercury the pointers shall return to their original reading, corrected for any change in atmospheric pressure, within 30 feet. Complete recovery shall have been effected in not more than 30 minutes after the pressure application.

TABLE I—ALTIMETER SCALE ERRORS

Standard altitude	Equivalent pressure mercury		Tolerance, feet plus or minus	
	MM	IN	Room temperature sec. 6.1	Low temperature sec. 7.1
0	760.0	29.92	20	75
500	746.4	29.39	20	
1,000	732.9	28.86	20	
1,500	719.7	28.33	25	
2,000	706.6	27.82	30	
3,000	681.1	26.81	30	
4,000	656.3	25.84	35	
6,000	609.0	23.98	40	130
8,000	564.4	22.22	60	
10,000	522.6	20.58	80	
12,000	483.3	19.03	120	230
14,000	446.4	17.57	140	
16,000	411.8	16.21	160	
18,000	379.4	14.94	180	340
20,000	349.1	13.75	200	
22,000	320.8	12.63	340	
25,000	281.9	11.10	375	500
30,000	225.6	8.88	450	
35,000	178.7	7.04	525	700
40,000	140.7	5.54	600	
45,000	110.8	4.36	675	
50,000	87.3	3.44	750	1,000

TABLE II

Tests	Reference section	Tolerance, feet plus or minus	
		Type I 35,000	Type II 50,000
Case leak	6.2	100	100
Position error test	6.3	20	20
Hysteresis	7.3		
First test point 25,000		70	150
Second test point 20,000		70	150
After effect test	7.4	50	60

TABLE III-a—ALTITUDE-PRESSURE TABLE—FEET-INCHES

[Altitude in feet, pressure in inches of mercury (° C.)]

P inches	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	P inches	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.8	80,522	80,262	80,005	79,751	79,501	79,252	79,008	78,766	78,526	78,289	11.6	23,983	23,963	23,944	23,924	23,904	23,884	23,864	23,844	23,824	23,805
0.9	78,056	77,825	77,596	77,369	77,145	76,924	76,705	76,488	76,273	76,060	11.7	785	765	745	726	706	686	666	647	627	607
1.0	75,850	75,641	75,435	75,231	75,029	74,828	74,629	74,433	74,238	74,045	11.8	588	568	549	529	509	499	470	451	431	412
1.1	73,854	73,665	73,477	73,291	73,107	72,924	72,743	72,563	72,384	72,207	11.9	392	373	353	334	314	295	275	256	237	217
1.2	72,032	71,858	71,686	71,515	71,346	71,178	71,011	70,845	70,681	70,518	12.0	198	23,178	23,159	23,140	23,121	23,101	23,082	23,063	23,043	23,024
1.3	70,357	70,196	70,037	69,879	69,722	69,566	69,411	69,258	69,106	68,955	12.1	23,005	22,986	22,966	22,947	22,928	22,909	22,890	22,870	22,851	22,832
1.4	68,805	68,656	68,508	68,361	68,215	68,070	67,926	67,784	67,642	67,501	12.2	22,813	794	775	756	737	718	698	679	660	641
1.5	67,361	67,221	67,082	66,945	66,809	66,674	66,539	66,405	66,272	66,140	12.3	622	603	584	565	547	528	509	490	471	452
1.6	66,009	65,879	65,749	65,620	65,492	65,365	65,239	65,113	64,988	64,864	12.4	433	414	395	377	358	339	320	301	282	264
1.7	64,740	64,617	64,495	64,374	64,253	64,133	64,014	63,895	63,777	63,660	12.5	245	226	207	189	22,170	22,151	22,133	22,114	22,095	22,077
1.8	63,543	63,427	63,311	63,196	63,082	62,969	62,856	62,744	62,632	62,521	12.6	22,058	22,040	22,021	22,002	21,984	21,965	21,947	21,928	21,910	21,891
1.9	62,411	62,301	62,191	62,082	61,974	61,867	61,760	61,654	61,548	61,442	12.7	21,872	21,854	21,836	21,817	799	780	762	743	725	706
2.0	61,337	61,232	61,128	61,025	60,922	60,820	60,618	60,617	60,516	60,416	12.8	688	670	651	633	615	596	578	560	542	523
2.1	60,315	60,215	60,116	60,018	59,920	59,823	59,726	59,629	59,533	59,437	12.9	505	487	469	450	432	414	396	377	359	341
2.2	59,341	59,246	59,152	59,058	58,964	58,871	58,778	58,686	58,594	58,502	13.0	323	305	287	268	250	232	214	196	21,178	21,160
2.3	58,411	58,320	58,229	58,139	58,049	57,960	57,871	57,782	57,691	57,606	13.1	21,142	21,124	21,106	21,088	21,070	21,052	21,034	21,016	20,998	20,980
2.4	57,519	57,432	57,345	57,259	57,173	57,088	57,003	56,918	56,833	56,749	13.2	20,962	20,914	20,926	20,908	20,890	20,873	20,855	20,837	819	801
2.5	56,665	56,581	56,498	56,415	56,332	56,250	56,168	56,086	56,005	55,924	13.3	783	765	748	730	712	694	677	659	611	623
2.6	55,844	55,763	55,683	55,603	55,524	55,445	55,366	55,287	55,209	55,131	13.4	605	588	570	552	535	517	499	482	464	446
2.7	55,053	54,975	54,898	54,821	54,745	54,669	54,593	54,517	54,442	54,367	13.5	429	411	394	376	358	341	323	306	288	271
2.8	54,292	54,217	54,143	54,069	53,995	53,921	53,848	53,775	53,702	53,629	13.6	253	236	218	201	183	20,166	20,149	20,131	20,114	20,096
2.9	53,557	53,485	53,413	53,341	53,270	53,199	53,127	53,057	52,987	52,917	13.7	20,079	20,061	20,044	20,027	20,009	19,992	19,975	19,957	19,940	19,922
3.0	52,847	52,777	52,707	52,638	52,570	52,501	52,432	52,364	52,296	52,228	13.8	19,905	19,888	19,871	19,853	19,836	819	802	784	767	750
3.1	52,161	52,093	52,026	51,959	51,892	51,826	51,759	51,693	51,627	51,561	13.9	733	715	698	681	664	647	630	613	595	578
3.2	51,496	51,430	51,365	51,300	51,235	51,171	51,107	51,043	50,979	50,916	14.0	561	544	527	510	493	476	459	442	425	408
3.3	50,852	50,789	50,726	50,663	50,600	50,537	50,475	50,413	50,351	50,290	14.1	391	374	357	340	323	306	289	272	255	238
3.4	50,228	50,167	50,104	50,044	49,982	49,922	49,862	49,801	49,741	49,680	14.2	221	204	187	170	19,154	19,137	19,120	19,103	19,086	19,069
3.5	49,620	49,561	49,501	49,442	49,382	49,323	49,264	49,206	49,147	49,089	14.3	19,052	19,036	19,019	19,002	18,985	18,969	18,952	18,935	18,918	18,902
3.6	49,030	48,972	48,915	48,857	48,799	48,741	48,684	48,627	48,570	48,513	14.4	18,885	18,868	18,852	18,835	818	802	785	768	752	735
3.7	48,456	48,400	48,344	48,288	48,232	48,175	48,120	48,065	48,009	47,954	14.5	718	702	685	668	652	635	619	602	586	569
3.8	47,898	47,843	47,789	47,734	47,679	47,624	47,570	47,516	47,462	47,408	14.6	553	536	520	503	487	470	454	437	421	401
3.9	47,354	47,301	47,248	47,194	47,141	47,088	47,035	46,982	46,930	46,877	14.7	388	371	355	339	322	306	289	273	257	240
4.0	46,824	46,772	46,720	46,668	46,616	46,564	46,513	46,461	46,410	46,358	14.8	224	208	191	175	18,159	18,142	18,126	18,110	18,093	18,077
4.1	46,307	46,256	46,206	46,155	46,104	46,053	46,003	45,953	45,903	45,853	14.9	18,061	18,045	18,028	18,012	17,996	17,980	17,963	17,947	17,931	17,915
4.2	45,803	45,753	45,704	45,654	45,605	45,555	45,506	45,458	45,408	45,359	15.0	17,899	17,882	17,866	17,850	834	818	802	786	770	754
4.3	45,310	45,262	45,213	45,165	45,117	45,068	45,020	44,973	44,925	44,877	15.1	737	721	705	689	673	657	641	625	609	593
4.4	44,829	44,782	44,734	44,687	44,640	44,592	44,546	499	44,452	44,405	15.2	577	561	545	529	513	497	481	465	449	433
4.5	44,358	44,312	44,266	44,220	44,173	44,127	44,081	44,036	43,990	43,944	15.3	417	402	386	370	354	338	322	306	290	275
4.6	43,898	43,853	43,808	43,762	43,717	43,672	43,627	43,582	537	492	15.4	259	243	227	211	196	180	164	17,148	17,132	17,117
4.7	448	43,403	43,359	43,315	43,270	43,226	43,182	43,138	43,094	43,050	15.5	17,101	17,085	17,069	17,054	17,038	17,022	17,007	16,991	16,975	16,959
4.8	43,007	42,962	42,920	42,876	42,833	42,790	42,747	42,704	42,661	42,618	15.6	16,944	16,928	16,912	16,897	16,881	16,866	16,850	834	819	803
4.9	42,575	532	490	447	42,404	42,362	42,320	42,278	42,236	42,193	15.7	787	772	756	741	725	710	694	679	663	648
5.0	42,151	42,110	42,068	42,026	41,985	41,943	41,902	41,861	41,819	41,778	15.8	632	617	601	586	570	555	539	524	508	493
5.1	41,737	41,696	41,655	41,614	573	532	492	451	411	370	15.9	477	462	447	431	416	400	385	370	354	339
5.2	41,330	41,290	41,250	41,210	41,170	41,130	41,090	41,050	41,011	40,971	16.0	324	308	293	278	262	247	232	216	201	186
5.3	40,931	40,892	40,853	40,813	40,774	40,735	40,696	40,657	40,618	579	16.1	171	155	16,140	16,125	16,110	16,094	16,079	16,064	16,049	16,034
5.4	540	502	463	425	386	40,347	40,309	40,271	40,233	40,195	16.2	16,018	16,003	15,988	15,973	15,958	15,943	15,927	15,912	15,897	15,882
5.5	40,156	40,118	40,080	40,043	40,005	39,967	39,929	39,892	39,854	39,816	16.3	15,867	15,852	837	822	806	791	776	761	746	731
5.6	39,779	39,742	39,704	39,667	39,630	593	556	519	482	445	16.4	716	701	686	671	656	641	626	611	596	581
5.7	408	372	39,335	39,298	39,262	39,225	39,189	39,153	39,117	39,080	16.5	566	551	536	521	506	491	476	461	446	431
5.8	39,044	39,008	38,972	38,936	38,900	38,864	38,829	38,793	38,757	38,722	16.6	416	402	387	372	357	342	327	312	298	283
5.9	38,686	38,651	615	580	545	509	474	439	404	369	16.7	268	253	238	224	209	194	179	164	150	15,135
6.0	38,334	38,300	38,265	38,230	38,200	38,161	38,126	38,092	38,057	38,023	16.8	15,120	15,105	15,091	15,076	15,061	15,047	15,032	15,017	15,002	14,988
6.1	37,989	37,954	37,920	37,886	37,852	37,818	37,784	37,750	37,716	37,682	16.9	14,973	14,958	14,944	14,929	14,914	14,900	14,885	14,870	14,856	841
6.2	648	615	581	547	514	480	447	413	380	346	17.0	826	812	797	783	768	753	739	724	710	695
6.3	37,313	37,280	37,247	37,214	37,181	37,147	37,115	37,082	37,049	37,016	17.1	681	666	652	637	622	608	594	579	564	550
6.4	36,983	36,951	36,918	36,886	36,853	36,820	36,788	36,756	36,723	36,691	17.2	536	521	507	492	478	463	449	434	420	406
6.5	659	627	595	563	531	498	467	435	403	371	17.3	391	377	362	348	334	319	305	291	276	262
6.6	339	36,308	36,276	36,245	36,213	36,181	36,150	36,119	36,087	36,056	17.4	247	233	219	204	190	176	162	147	14,133	14,119
6.7	36,024	35,993	35,962	35,931	35,900	35,869	35,838	35,807	35,776	35,745	17.5	14,104	14,090	14,076	14,062	14,047	14,033	14,019	14,005	13,990	13,976
6.8	35,714	683	653	622	591	560	530	499	469	438	17.6	13,962	13,948	13,934	13,919	13,905	13,891	13,877	13,863	849	834
6.9	408	378	347	317	35,287	35,257	35,227	35,197	35,167	35,136	17.7	820	806	792	778	764	750	736	722	707	693
7.0	35,106	35,077	35,047	35,017	34,987	34,957	34,927	34,898	34,868	34,838	17.8	679	665	651	637	623	609	595	581	567	553
7.1	34,809	34,779	34,749	34,720	690	661	631	602	573	543	17.9	539	525	511	497	483	469	455	441	427	413
7.2	514	485	455	426	397	368	339	310	34,281	34,251	18.0	399	385	371	357	343	329	315	301	287	274
7.3	34,222	34,194	34,165	34,136	34,107	34,078	34,049	34,020	33,992	33,963	18.1	260	246	232	218	204	190	176	163	149	13,135
7.4	33,934	33,906	33,877	33,848	33,820	33,791	33,763	33,734	706	678	18.2	13,121	13,107	13,094	13,080	13,066	13,052	13,038	13,025	13,011	12,997
7.5	649	621	593	564	536	508	480	452	424	395	18.3	12,983	12,970	12,956	12,942	12,928	12,915	12,901	12,887	12,873	860
7.6	367	339	311	283	33,255	33,227	33,200	33,172	33,144	33,116	18.4	846	832	819	805	791	778	764	750	736	723
7.7	33,088	33,061	33,033	33,005	32,978	32,950	32,922	32,895	32,867	32,840	18.5	709	695	682	668	655	641	627	614	600	587
7.8	32,812	32,785	32,758	32,730	703	676	648	621	594	567	18.6	573	559	546	532	519	505	492	478	464	451
7.9	539	512	485	458	431	404	377	350	323	296	18.7	437	424	410	397	383	370	356	343	329	316
8.0	269	32,242	32,215	32,188	32,161	32,135	32,108	32,081	32,054	32,028	18.8	302	289	275	262	249	235	222	208	195	181
8.1	32,001	31,975	31,948	31,921	31,895	31,868	31,842	31,815	31,789	31,763	18.9	168	155	141	12,128	12,114	12,101	12,088	12,074	12,061	12,048
8.2	31,736	710	684	657	631	605	578	552	526	500	19.0	12,034	12,021	12,008	11,994	11,981	11,968	11,954	11,941	11,928	11,914
8.3	474	448	422	396	370	344	318	292	266	31,240	19.1	11,901	11,888	11,874	861	848	835	821	808	795	781
8.4	31,214	31,188	31,163	31,137	31,111	31,085	31,060	31,034	31,008	30,983	19.2	768	755	742	729	715	702	689	676	663	649
8.5	30,957	30,931	30,906	30,880	30,855	30,829	30,804	30,778	30,753	728	19.3	636	623	610	597	584	570	557	544	531	518
8.6	702	677	652	626	601	576	550	525	500	475	19.4	505	491	478	465	452	439	426	413	400	387
8.7	449	424	399	374	349	324	299	274	249	30,224	19.5	374	360	347	334	321	308	295	282	269	256
8.8	30,199	30,174	30,149	30,125	30,100	30,075	30,050	30,025	30,001	29,976	19.6	243	230	217	204	191	178	165	152	139	11,126
8.9	29,951	29,927	29,902	29,877	29,853	29,828	29,804	29,779	29,755	730	19.7	11,113	11,100	11,087	11,074	11,061	11,048	11,035	11,023	11,010	10,997
9.0	706	681	657	633	608	584	560	535	511	487	19.8	10,984	10,971	10,958	10,945	10,932	10,919	10,906	10,894	10,881	868
9.1	462	438	414	390	366	342	317	293	269	245	19.9	855	842	829	816	804	791	778	765	752	739
9.2	29,221	29,197	29,173	29,149	29,125	29,101	29,077	29,053	29,029	29,005	20.0	726	714	701	688	675	662	650	637	624	611
9.3	28,982	28,958	28,934	28,910	28,887	28,863	28,839	28,816	28,792	28,768	20.1	599	586	573	560	548	535	522	509	497	481
9.4	745	721	698	674	650	627	603	580	556	533	20.2	471	459	446	433	421	408	395	383	370	357
9.5	510	486	463	439	416	393	369	346	323	300	20.3	344	332	319	307	294	281	269	256	213	231
9.6	276	253	230	28,207	28,184	28,161	28,138	28,115	28,092	28,069	20.4	218	206	193	180	168	155	143	130	10,117	10,105
9.7	28,046	28,023	28,000	27,977	27,954	27,931	27,908	27,885	27,862	27,839	20.5	10,092	10,080	10,067	10,055	10,042	10,030	10,017	10,005	9,992	9,980
9.8	27,816	27,794	27,771	748	725	702	680	657	634	612	20.6	9,967	9,955	9,942	9,930	9,917	9,905	9,892	9,880	9,867	9,855
9.9	589	566	544	521	499	476	453	431	408	386	20.7	9,842	9,830	9,817	9,805	9,793	9,780	9,768	9,755	9,743	9,730
10.0	363	341	318	396	274	251	229	27,206	27,184	27,162	20.8	9,718	9,706	9,693	9,681	9,668	9,656	9,644	9,631	9,619	9,607
10.1	27,140	117	095	073	050	028	006	26,984	26,962	26,940	20.9	9,594	9,582	9,570	9,557	9,545	9,532	9,520	9,508	9,495	9,483
10.2	26,917	895	873	851	829	807	785	763	741	719	21.0	9,471	9,458	9,446	9,434	9,422	9,409	9,397	9,385	9,372	9,360
10.3	697	676	654	632	610	588	566	544	523	501	21.1	9,348	9,336	9,323	9,311	9,299	9,287	9,274	9,262	9,250	9,238
10.4	479	457	436	27,414	27,392	27,371	27,349	327	306	284	21.2	9,225	9,213	9,201	9,189	9,176	9,164	9,152	9,140	9,128	9,116
10.5	262	27,241	27,219	26,198	26,176	26,155	26,133	26,112	26,090	26,069	21.3	9,103	9,091	9,079	9,067	9,055	9,043	9,030	9,018	9,006	8,994
10.6	26,048	26,026	26,005	25,984	25,962	25,941	25,919	25,898	25,877	25,856	21.4	8,982	8,970	8,958	8,946	8,933	8,921	8,909	8,897	8,885	8,873
10.7	25,834	25,813	25,792	771	749	728	707	686	665	644	21.5	8,861	8,849	8,837	8,825	8,813	8,801	8,789	8,776	8,764	8,752
10.8	622	601	580	559	538	517	496	475	454	433	21.6	8,740	8,728	8,716	8,704	8,692	8,680	8,668	8,656	8,644	8,632
10.9	412	391	370	350	329	308	287	266	245	224	21.7	8,620	8,608	8,596	8,584	8,572	8,560	8,548	8,536	8,524	8,512
11.0	25,204	25,183	25,162	25,141	25,121	25,100	25,079	25,059	25,038	25,017	21.8	8,500	8,489	8,477	8,465	8,453	8,441	8,429	8,417	8,405	8,393
11.1	24,996	24,976	24,955	24,935	24,914	24,894	24,873	24,852	24,832	24,811	21.9	8,381	8,369	8,357	8,346	8,334	8,322	8,310	8,298	8,286	8,274
11.2	791	770	750	730	709	689	668	648	628	607	22.0	8,262	8,250	8,239	8,227	8,215	8,203	8,191	8,179	8,168	8,156
11.3	587	567	546	526	506	486	465	445	425	405	22.1	8,144	8,132	8,120	8,109	8,097	8,085	8,073	8,061	8,050	8,038
11.4	384	364	344	324	304	284	263	243	223	203	22.2	8,026	8,014	8,003	7,991	7,979	7,967	7,956	7,944	7,932	7,920
11.5	24,183	24,163	24,143	24,123	24,103	24,083	24,063	24,043	24,023	24,003	22.3	7,909	7,897	7,885	7,873	7,862	7,850	7,838	7,827	7,815	7,803

TABLE III-a—ALTITUDE-PRESSURE TABLE—FEET-INCHES—Continued

[Altitude in feet, pressure in inches of mercury (° C.)]

P inches	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
22.4	7,791	7,780	7,768	7,756	7,745	7,733	7,721	7,710	7,698	7,686
22.5	7,675	7,663	7,652	7,640	7,628	7,617	7,605	7,593	7,582	7,570
22.6	7,559	7,547	7,535	7,524	7,512	7,501	7,489	7,478	7,466	7,454
22.7	7,443	7,431	7,420	7,408	7,397	7,385	7,374	7,362	7,350	7,339
22.8	7,327	7,316	7,304	7,293	7,281	7,270	7,258	7,247	7,235	7,224
22.9	7,212	7,201	7,189	7,178	7,167	7,155	7,144	7,132	7,121	7,109
23.0	7,098	7,086	7,075	7,064	7,052	7,041	7,029	7,018	7,006	6,995
23.1	6,984	6,972	6,961	6,949	6,938	6,927	6,915	6,904	6,893	6,881
23.2	6,870	6,858	6,847	6,836	6,824	6,813	6,802	6,790	6,779	6,768
23.3	6,756	6,745	6,734	6,722	6,711	6,700	6,688	6,677	6,666	6,655
23.4	6,643	6,632	6,621	6,610	6,598	6,587	6,576	6,564	6,553	6,542
23.5	6,531	6,519	6,508	6,497	6,486	6,475	6,463	6,452	6,441	6,430
23.6	6,418	6,407	6,396	6,385	6,374	6,363	6,351	6,340	6,329	6,318
23.7	6,307	6,296	6,284	6,273	6,262	6,251	6,240	6,229	6,218	6,206
23.8	6,195	6,184	6,173	6,162	6,151	6,140	6,129	6,118	6,106	6,095
23.9	6,084	6,073	6,062	6,051	6,040	6,029	6,018	6,007	5,996	5,985
24.0	5,974	5,962	5,951	5,940	5,929	5,918	5,907	5,896	5,885	5,874
24.1	5,863	5,852	5,841	5,830	5,819	5,808	5,797	5,786	5,775	5,764
24.2	5,753	5,742	5,731	5,720	5,709	5,698	5,687	5,676	5,666	5,655
24.3	5,644	5,633	5,622	5,611	5,600	5,589	5,578	5,567	5,555	5,545
24.4	5,534	5,524	5,513	5,502	5,491	5,480	5,469	5,458	5,447	5,436
24.5	5,425	5,415	5,404	5,393	5,382	5,371	5,360	5,350	5,339	5,328
24.6	5,317	5,306	5,295	5,285	5,274	5,263	5,252	5,241	5,230	5,220
24.7	5,209	5,198	5,187	5,176	5,166	5,155	5,144	5,133	5,133	5,112
24.8	5,101	5,090	5,080	5,069	5,058	5,047	5,037	5,026	5,015	5,004
24.9	4,994	4,983	4,972	4,961	4,951	4,940	4,929	4,919	4,908	4,897
25.0	4,886	4,876	4,865	4,854	4,844	4,833	4,822	4,812	4,801	4,790
25.1	4,780	4,769	4,758	4,748	4,737	4,726	4,716	4,705	4,695	4,684
25.2	4,673	4,663	4,652	4,642	4,631	4,620	4,610	4,599	4,588	4,578
25.3	4,567	4,557	4,546	4,536	4,525	4,514	4,504	4,493	4,483	4,472
25.4	4,462	4,451	4,440	4,430	4,419	4,409	4,398	4,388	4,377	4,367
25.5	4,356	4,346	4,335	4,325	4,314	4,304	4,293	4,283	4,272	4,262
25.6	4,251	4,241	4,230	4,210	4,209	4,199	4,188	4,178	4,167	4,157
25.7	4,146	4,136	4,125	4,115	4,105	4,094	4,084	4,073	4,063	4,052
25.8	4,042	4,032	4,021	4,011	4,000	3,990	3,980	3,969	3,959	3,948
25.9	3,938	3,928	3,917	3,907	3,896	3,886	3,876	3,865	3,855	3,845
26.0	3,834	3,824	3,814	3,803	3,793	3,782	3,772	3,762	3,751	3,741
26.1	3,731	3,720	3,710	3,700	3,689	3,679	3,669	3,659	3,648	3,638
26.2	3,628	3,617	3,607	3,597	3,586	3,576	3,566	3,556	3,545	3,535
26.3	3,525	3,515	3,504	3,494	3,484	3,474	3,463	3,453	3,443	3,433
26.4	3,422	3,412	3,402	3,392	3,382	3,371	3,361	3,351	3,341	3,331
26.5	3,320	3,310	3,300	3,290	3,279	3,269	3,259	3,249	3,239	3,229
26.6	3,218	3,208	3,198	3,188	3,178	3,168	3,157	3,147	3,137	3,127
26.7	3,117	3,107	3,097	3,086	3,076	3,066	3,056	3,046	3,036	3,026
26.8	3,016	3,005	2,995	2,985	2,975	2,965	2,955	2,945	2,935	2,925
26.9	2,915	2,905	2,895	2,884	2,874	2,864	2,854	2,844	2,834	2,824
27.0	2,814	2,804	2,794	2,784	2,774	2,764	2,754	2,744	2,734	2,724
27.1	2,714	2,704	2,694	2,684	2,674	2,664	2,654	2,644	2,634	2,624
27.2	2,614	2,604	2,594	2,584	2,574	2,564	2,554	2,544	2,534	2,524
27.3	2,514	2,504	2,494	2,484	2,474	2,464	2,454	2,444	2,434	2,425
27.4	2,415	2,405	2,395	2,385	2,375	2,365	2,355	2,345	2,335	2,325
27.5	2,315	2,306	2,296	2,286	2,276	2,266	2,256	2,246	2,236	2,226
27.6	2,217	2,207	2,197	2,187	2,177	2,167	2,158	2,148	2,138	2,128
27.7	2,118	2,108	2,098	2,089	2,079	2,069	2,059	2,049	2,040	2,030
27.8	2,020	2,010	2,000	1,990	1,981	1,971	1,961	1,951	1,942	1,932
27.9	1,922	1,912	1,912	1,893	1,883	1,873	1,863	1,854	1,844	1,834
28.0	1,824	1,814	1,805	1,795	1,785	1,776	1,766	1,756	1,746	1,737
28.1	1,727	1,717	1,707	1,698	1,688	1,678	1,668	1,659	1,649	1,639
28.2	1,630	1,620	1,610	1,601	1,591	1,581	1,572	1,562	1,552	1,542
28.3	1,533	1,523	1,513	1,504	1,494	1,484	1,475	1,465	1,456	1,446
28.4	1,436	1,427	1,417	1,407	1,398	1,388	1,378	1,369	1,359	1,350
28.5	1,340	1,330	1,321	1,311	1,302	1,292	1,282	1,273	1,263	1,254
28.6	1,244	1,234	1,225	1,215	1,206	1,196	1,186	1,177	1,167	1,158
28.7	1,148	1,139	1,129	1,120	1,110	1,100	1,091	1,081	1,072	1,062
28.8	1,053	1,043	1,034	1,024	1,015	1,005	995	986	976	967
28.9	957	948	938	929	919	910	900	891	881	872
29.0	863	853	844	834	825	815	806	796	787	777
29.1	768	758	749	739	730	721	711	702	692	683
29.2	673	664	655	645	636	626	617	607	598	589
29.3	579	570	560	551	542	532	523	514	504	495
29.4	485	476	467	457	448	439	429	420	410	401
29.5	392	382	373	364	354	345	335	326	317	307
29.6	298	289	280	270	261	252	242	233	224	215
29.7	205	196	187	177	168	159	149	140	131	122
29.8	112	103	94	85	75	66	57	47	38	29
29.9	20	10	1	−8	−17	−26	−36	−45	−54	−63
30.0	−73	−82	−91	−100	−110	−119	−128	−137	−146	−156
30.1	−165	−174	−183	−192	−202	−211	−220	−229	−238	−248
30.2	−257	−266	−275	−284	−293	−303	−312	−321	−330	−339
30.3	−348	−358	−367	−376	−385	−394	−403	−412	−421	−431
30.4	−440	−449	−458	−467	−476	−485	−494	−504	−513	−522
30.5	−531	−540	−549	−558	−567	−576	−585	−594	−604	−613
30.6	−622	−631	−640	−649	−658	−667	−676	−685	−694	−703
30.7	−712	−721	−730	−740	−749	−758	−767	−776	−785	−794
30.8	−803	−812	−821	−830	−839	−848	−857	−866	−875	−884
30.9	−893	−902	−911	−920	−929	−938	−947	−956	−965	−974
31.0	−983	−992	−1,001	−1,010	−1,019	−1,028	−1,037	−1,046	−1,055	−1,064

TABLE III-b—ALTITUDE-PRESSURE TABLE—FEET-MILLIBARS

[Altitude in feet, pressure in millibars]

Pressure Millibars	0	1	2	3	4	5	6	7	8	9
10	101,389	99,393	97,573	95,896	94,346	92,899	91,548	90,279	89,082	87,950
20	86,876	85,854	84,880	83,950	83,059	82,204	81,383	80,592	79,832	79,099
30	78,386	77,700	77,035	76,392	75,766	75,159	74,569	73,996	73,437	72,891
40	72,363	71,816	71,341	70,850	70,367	69,897	69,437	68,986	68,545	68,114
50	67,691	67,277	66,870	66,470	66,079	65,695	65,318	64,947	64,583	64,226
60	63,873	63,527	63,187	62,852	62,522	62,198	61,878	61,563	61,253	60,947
70	60,646	60,348	60,056	59,768	59,483	59,202	58,924	58,651	58,381	58,114
80	57,850	57,590	57,333	57,079	56,828	56,580	56,335	56,093	55,854	55,617
90	55,383	55,152	54,924	54,697	54,474	54,252	54,032	53,815	53,601	53,388
100	53,178	52,969	52,763	52,559	52,357	52,157	51,958	51,761	51,566	51,374
110	51,182	50,993	50,805	50,619	50,433	50,251	50,071	49,891	49,713	49,536
120	50,360	49,187	49,014	48,844	48,674	48,506	48,339	48,173	48,009	47,846
130	47,685	47,525	47,365	47,207	47,050	46,895	46,740	46,587	46,434	46,283
140	46,133	45,984	45,836	45,690	45,543	45,399	45,255	45,111	44,970	44,829
150	44,689	44,550	44,411	44,274	44,138	44,002	43,867	43,734	43,601	43,469
160	43,337	43,207	43,077	42,918	42,820	42,693	42,566	42,440	42,315	42,191
170	42,067	41,944	41,822	41,701	41,580	41,460	41,341	41,222	41,104	40,987
180	40,870	40,754	40,639	40,525	40,411	40,297	40,181	40,072	39,961	398,50
190	39,739	39,629	39,520	39,411	39,303	39,195	39,088	38,981	38,875	38,769
200	38,664	38,560	38,456	38,353	38,250	38,148	38,046	37,945	37,844	37,744
210	37,644	37,544	37,445	37,347	37,249	37,151	37,054	36,957	36,861	36,765
220	36,669	36,575	36,480	36,386	36,292	36,199	36,106	36,014	35,922	35,830
230	35,739	35,648	35,557	35,467	35,377	35,288	35,199	35,110	35,022	34,931
240	34,816	34,759	34,672	34,585	34,498	34,412	34,326	34,240	34,154	34,069
250	33,984	33,900	33,815	33,731	33,647	33,564	33,481	33,398	33,315	33,232
260	33,150	33,068	32,986	32,905	32,823	32,743	32,662	32,581	32,501	32,421
270	32,341	32,262	32,182	32,103	32,024	31,946	31,867	31,789	31,711	31,634
280	31,556	31,479	31,402	31,325	31,249	31,172	31,096	31,021	30,945	30,869
290	30,794	30,719	30,644	30,570	30,495	30,421	30,317	30,273	30,199	30,126
300	30,052	29,979	29,907	29,834	29,762	29,690	29,618	29,546	29,474	29,403
310	29,331	29,260	29,189	29,118	29,048	28,977	28,907	28,837	28,767	28,697
320	28,628	28,559	28,489	28,420	28,351	28,283	28,214	28,146	28,078	28,011
330	27,943	27,875	27,807	27,740	27,673	27,606	27,539	27,473	27,406	27,340
340	27,273	27,207	27,141	27,076	27,010	26,945	26,879	26,814	26,749	26,685
350	26,620	26,555	26,491	26,427	26,363	26,299	26,235	26,172	26,108	26,045
360	25,982	25,919	25,856	25,793	25,730	25,668	25,606	25,544	25,482	25,429
370	25,358	25,296	25,234	25,173	25,112	25,051	24,990	24,929	24,868	24,807
380	24,747	24,687	24,627	24,567	24,507	24,417	24,387	24,328	24,268	24,209
390	21,150	24,091	24,032	23,973	23,914	23,855	23,797	23,739	23,680	23,622
400	23,564	23,506	23,449	23,391	23,333	23,276	23,218	23,161	23,104	23,047
410	22,990	22,934	22,877	22,821	22,764	22,708	22,652	22,596	22,540	22,484
420	22,428	22,372	22,316	22,261	22,206	22,151	22,095	22,040	21,986	21,931
430	21,876	21,821	21,767	21,713	21,658	21,604	21,550	21,496	21,442	21,388
440	21,335	21,281	21,228	21,174	21,121	21,068	21,015	20,962	20,909	20,856
450	20,804	20,751	20,698	20,645	20,593	20,541	20,489	20,437	20,385	20,333
460	20,281	20,229	20,178	20,126	20,075	20,024	19,973	19,921	19,870	19,819
470	19,769	19,718	19,667	19,616	19,566	19,515	19,465	19,414	19,364	19,314
480	19,264	19,214	19,165	19,115	19,065	19,015	18,966	18,917	18,867	18,818
490	18,769	18,720	18,670	18,621	18,573	18,524	18,475	18,426	18,378	18,330
500	18,281	18,233	18,185	18,136	18,088	18,040	17,993	17,945	17,897	17,849
510	17,802	17,754	17,706	17,659	17,612	17,564	17,517	17,470	17,423	17,376
520	17,329	17,282	17,235	17,189	17,142	17,096	17,049	17,003	16,956	16,910
530	16,864	16,818	16,772	16,726	16,680	16,634	16,589	16,543	16,497	16,452
540	16,406	16,361	16,316	16,270	16,225	16,180	16,135	16,090	16,045	16,000
550	15,955	15,911	15,866	15,821	15,777	15,732	15,688	15,644	15,599	15,555
560	15,511	15,467	15,428	15,379	15,335	15,291	15,217	15,203	15,160	15,116
570	15,073	15,029	14,986	14,943	14,899	14,856	11,813	14,770	14,726	14,683
580	14,641	14,598	14,555	14,510	14,470	11,427	14,384	14,342	14,300	14,257
590	14,214	11,172	14,130	14,088	14,046	14,001	13,962	13,920	13,878	13,836
600	13,795	13,753	13,711	13,670	13,628	13,587	13,545	13,504	13,463	13,422
610	13,380	13,339	13,298	13,257	13,216	13,175	13,134	13,093	13,052	13,012
620	12,972	12,931	12,890	12,850	12,809	12,769	12,728	12,688	12,648	12,608
630	12,568	12,528	12,488	12,448	12,408	12,368	12,328	12,288	12,248	12,209
640	12,169	12,130	12,090	12,051	12,011	11,972	11,932	11,893	11,854	11,815
650	11,776	11,737	11,698	11,659	11,620	11,581	11,512	11,503	11,464	11,426
660	11,387	11,349	11,310	11,271	11,233	11,195	11,156	11,118	11,079	11,041
670	11,003	10,965	10,927	10,889	10,851	10,813	10,775	10,737	10,699	10,661
680	10,624	10,586	10,548	10,510	10,473	10,435	10,398	10,360	10,323	10,286
690	10,249	10,211	10,174	10,137	10,100	10,063	10,026	9,989	9,952	9,915
700	9,878	9,841	9,805	9,768	9,732	9,695	9,659	9,622	9,585	9,548
710	9,512	9,476	9,440	9,403	9,367	9,331	9,295	9,258	9,222	9,186
720	9,150	9,114	9,079	9,043	9,007	8,970	8,934	8,899	8,864	8,828
730	9,792	8,757	8,721	8,685	8,650	8,615	8,579	8,544	8,509	8,473
740	8,438	8,403	8,368	8,333	8,298	8,262	8,222	8,192	8,158	8,123
750	8,088	8,053	8,018	7,983	7,949	7,914	7,880	7,815	7,810	7,776
760	7,742	7,707	7,672	7,638	7,604	7,570	7,535	7,501	7,467	7,433
770	7,398	7,364	7,330	7,296	7,262	7,229	7,195	7,161	7,127	7,094
780	7,060	7,026	6,992	6,958	6,925	6,891	6,857	6,823	6,791	6,757
790	6,724	6,690	6,657	6,624	6,590	6,557	6,524	5,491	6,458	6,425
800	6,392	6,359	6,326	6,293	6,260	6,227	6,194	6,164	6,128	6,096
810	6,068	6,030	5,998	5,965	5,932	5,900	5,867	5,835	5,802	5,769
820	5,737	5,705	5,672	5,640	5,608	5,576	5,543	5,511	5,472	5,147
830	5,415	5,383	5,351	5,319	5,287	5,255	5,223	5,191	5,159	5,127
840	5,096	5,064	5,032	5,000	4,969	4,937	4,905	4,874	4,842	4,811
850	4,779	4,748	4,716	4,685	4,654	4,622	4,591	4,560	4,528	4,497
860	4,466	4,435	4,404	4,373	4,312	4,311	4,280	4,249	4,218	4,187
870	4,156	4,125	4,094	4,063	4,032	4,002	3,971	3,940	3,910	3,879
880	3,848	3,818	3,787	3,757	3,726	3,696	3,665	3,635	3,604	3,574
890	3,544	3,513	3,483	3,453	3,423	3,393	3,362	3,332	3,302	3,272
900	3,212	3,212	3,182	3,152	3,122	3,092	3,062	3,032	3,002	2,973
910	2,943	2,913	2,883	2,854	2,824	2,794	2,765	2,735	2,705	2,676
920	2,646	2,617	2,587	2,558	2,529	2,499	2,470	2,411	2,411	2,332
930	2,352	2,323	2,204	2,265	2,236	2,206	2,177	2,148	2,119	2,090
940	2,061	2,032	2,003	1,974	1,915	1,916	1,887	1,859	1,830	1,801
950	1,772	1,743	1,715	1,686	1,657	1,629	1,600	1,572	1,543	1,514
960	1,486	1,458	1,429	1,400	1,372	1,344	1,315	1,287	1,258	1,230
970	1,202	1,174	1,145	1,117	1,089	1,061	1,033	1,005	977	948
980	920	892	865	836	808	780	752	724	697	669
990	641	613	585	558	530	502	474	447	419	391
1,000	364	336	309	281	254	226	190	171	144	147
1,010	89	62	34	7	−20	−48	−75	−102	−129	−156
1,020	−183	−210	−238	−265	−292	−319	−346	−373	−400	−427
1,030	−454	−481	−508	−535	−562	−589	−615	−642	−669	−696
1,040	−722	−749	−776	−803	−830	−856	−883	−909	−936	−963
1,050	−989	−1,016	−1,042	−1,069	−1,095	−1,121	−1,148	−1,174	−1,200	−1,226
1,060	−1,253	−1,278	−1,304	−1,331	−1,357	−1,384	−1,410	−1,437	−1,463	−1,490
1,070	−1,516									

TABLE IV—ALTITUDE-PRESSURE-TEMPERATURE TABLE

Altitude, feet	Pressure		Temperature, ° C.	Mean temperature, ° C.	Altitude, feet	Pressure		Temperature, ° C.	Mean temperature, ° C.
	in. Hg	mm Hg				in. Hg	mm Hg		
−1,000	31.02	787.9	17.0	16.0	32,500	7.91	201.0	−49.4	−18.6
−500	30.47	773.8	16.0	15.5	33,000	7.73	196.4	−50.4	−19.1
0	29.921	760.0	15.0	15.0	33,500	7.55	191.8	−51.4	−19.6
500	29.38	746.4	14.0	14.5	34,000	7.38	187.4	−52.4	−20.2
1,000	28.86	732.9	13.0	14.0	34,500	7.20	183.0	−53.4	−20.7
1,500	28.33	719.7	12.0	13.0	35,000	7.04	178.7	−54.3	−21.3
2,000	27.82	706.6	11.0	13.5	35,332	6.93	175.9	−55.0	−21.6
2,500	27.31	693.8	10.0	12.0	35,500	6.87	174.5	−55.0	−21.8
3,000	26.81	681.1	9.1	12.5	36,000	6.71	170.4	−55.0	−22.3
3,500	26.32	668.6	8.1	11.0	36,500	6.55	166.4	−55.0	−22.8
4,000	25.84	656.3	7.1	11.5	37,000	6.39	162.4	−55.0	−23.3
4,500	25.36	644.2	6.1	10.0	37,500	6.24	158.6	−55.0	−23.8
5,000	24.89	632.3	5.1	10.5	38,000	6.10	154.9	−55.0	−24.3
5,500	24.43	620.6	4.1	9.5	38,500	5.95	151.2	−55.0	−24.8
6,000	23.98	609.0	3.1	9.0	39,000	5.81	147.6	−55.0	−25.2
6,500	23.53	597.6	2.1	8.5	39,500	5.68	144.1	−55.0	−25.6
7,000	23.09	586.4	1.1	8.0	40,000	5.54	140.7	−55.0	−26.0
7,500	22.65	575.3	0.1	7.5	40,500	5.41	137.4	−55.0	−26.4
8,000	22.22	564.4	−0.8	7.0	41,000	5.28	134.2	−55.0	−26.8
8,500	21.80	553.7	−1.8	6.5	41,500	5.16	131.0	−55.0	−27.2
9,000	21.38	543.2	−2.8	6.0	42,000	5.04	127.9	−55.0	−27.6
9,500	20.98	532.8	−3.8	5.5	42,500	4.92	124.9	−55.0	−28.0
10,000	20.58	522.6	−4.8	5.0	43,000	4.80	122.0	−55.0	−28.3
10,500	20.18	512.5	−5.8	4.5	43,500	4.69	119.1	−55.0	−28.6
11,000	19.79	502.6	−6.8	4.0	44,000	4.58	116.3	−55.0	−29.0
11,500	19.40	492.8	−7.8	3.5	44,500	4.47	113.5	−55.9	−29.3
12,000	19.03	483.3	−8.8	2.9	45,000	4.36	110.8	−55.0	−29.6
12,500	18.65	473.8	−9.8	2.4	45,500	4.26	108.2	−55.0	−29.9
13,000	18.29	464.5	−10.8	1.9	46,000	4.16	105.7	−55.0	−30.2
13,500	17.93	455.4	−11.7	1.4	46,500	4.06	103.2	−55.0	−30.5
14,000	17.57	446.4	−12.7	0.9	47,000	3.97	100.7	−55.0	−30.8
14,500	17.22	437.5	−13.7	0.4	47,500	3.873	98.38	−55.0	−31.1
15,000	16.88	428.8	−14.7	−0.1	48,000	3.781	96.05	−55.0	−31.4
15,500	16.54	420.2	−15.7	−0.6	48,500	3.693	93.79	−55.0	−31.7
16,000	16.21	411.8	−16.7	−1.2	49,000	3.605	91.57	−55.0	−31.9
16,500	15.89	403.5	−17.7	−1.7	49,500	3.520	89.41	−55.0	−32.2
17,000	15.56	395.3	−18.7	−2.2	50,000	3.436	87.30	−55.0	−32.4
17,500	15.25	387.3	−19.7	−2.7	51,000	3.276	83.22	−55	----------
18,000	14.94	379.4	−20.7	−3.2	52,000	3.124	79.34	−55	----------
18,500	14.63	371.7	−21.7	−3.7	53,000	2.978	75.64	−55	----------
19,000	14.33	364.0	−22.6	−4.3	54,000	2.839	72.12	−55	----------
19,500	14.04	356.5	−23.6	−4.8	55,000	2.707	68.76	−55	----------
20,000	13.75	349.1	−24.6	−5.3	56,000	2.581	65.55	−55	----------
20,500	13.46	341.9	−25.6	−5.6	57,000	2.460	62.49	−55	----------
21,000	13.18	334.7	−26.6	−6.3	58,000	2.346	59.58	−55	----------
21,500	12.90	327.7	−27.6	−6.9	59,000	2.236	56.80	−55	----------
22,000	12.63	320.8	−28.6	−7.4	60,000	2.132	54.15	−55	----------
22,500	12.36	314.1	−29.6	−7.9	61,000	2.033	51.63	−55	----------
23,000	12.10	307.4	−30.6	−8.4	62,000	1.938	49.22	−55	----------
23,500	11.84	300.9	−31.6	−9.0	63,000	1.847	46.92	−55	----------
24,000	11.59	294.4	−32.5	−9.5	64,000	1.761	44.73	−55	----------
24,500	11.34	288.1	−33.5	−10.0	65,000	1.679	42.65	−55	----------
25,000	11.10	281.9	−34.5	−10.5	66,000	1.601	40.66	−55	----------
25,500	10.86	275.8	−35.5	−11.1	67,000	1.526	38.76	−55	----------
26,000	10.62	269.8	−36.5	−11.6	68,000	1.455	36.95	−55	----------
26,500	10.39	263.9	−37.5	−12.1	69,000	1.387	35.23	−55	----------
27,000	10.16	258.1	−38.5	−12.7	70,000	1.322	33.59	−55	----------
27,500	9.94	252.5	−39.5	−13.2	71,000	1.261	32.02	−55	----------
28,000	9.72	246.9	−40.5	−13.7	72,000	1.202	30.53	−55	----------
28,500	9.50	241.4	−41.5	−14.3	73,000	1.146	29.10	−55	----------
29,000	9.29	236.0	−42.5	−14.8	74,000	1.093	27.75	−55	----------
29,500	9.08	230.7	−43.4	−15.3	75,000	1.041	26.45	−55	----------
30,000	8.88	225.6	−44.4	−15.9	76,000	0.993	25.22	−55	----------
30,500	8.68	220.5	−45.4	−16.4	77,000	0.946	24.04	−55	----------
31,000	8.48	215.5	−46.4	−16.9	78,000	0.902	22.92	−55	----------
31,500	8.29	210.6	−47.4	−17.5	79,000	0.860	21.85	−55	----------
32,000	8.10	205.8	−48.4	−18.0	80,000	0.820	20.83	−55	----------

(2) *Application.* (i) Sensitive altimeters complying with the specifications appearing in this section are hereby approved for all aircraft. Sensitive altimeters already approved by the Administrator may continue to be installed in aircraft

(*a*) For which an application for original type certificate is made prior to the effective date of this section,

(*b*) The prototype of which is flown within one year after the effective date of this section, and

(*c*) The prototype of which is not flown within one year after the effective date of this section if due to causes beyond the applicant's control.

(ii) If an alteration involving a change in type or model of sensitive altimeters is made within nine months after the effective date of this section, previously approved types of sensitive altimeters may be installed. However, in any such change made after the nine-month period, new types of sensitive altimeters installed in aircraft used in instrument flight shall meet the specifications contained herein.

(c) *Specific instructions*—(1) *Marking.* In addition to the identification information required in the referenced specification, each sensitive altimeter shall be permanently marked with the Technical Standard Order designation, CAA-TSO, C10a, to identify the altimeter as meeting the requirements of this section in accordance with the manufacturers' statement of conformance outlined below. This identification will be accepted by the Civil Aeronautics Administration as evidence that the established minimum safety requirements for sensitive altimeters have been met.

(2) *Data requirements.* None.

(3) *Effective date.* After March 1, 1949, specifications contained in this section will constitute the basis for Civil Aeronautics Administration approval of sensitive altimeters for use in certificated aircraft used in instrument flight.

(4) *Deviations.* Requests for deviation from, or waiver of, the requirements of this section; which affect the basic airworthiness of the component, should be submitted for approval by the Chief, Aircraft Service, Office of Aviation Safety, Civil Aeronautics Administration. These requests should be addressed to the nearest Regional Office of the Civil Aeronautics Administration, Attention: Superintendent, Aircraft Branch.

(5) *Conformance.* (i) The manufacturer shall furnish to the Civil Aeronautics Administration, Aircraft Service, Attention: A-298, Washington 25, D. C., a written statement of conformance signed by a responsible official of his company, setting forth that the sensitive altimeter to be produced by him meets the minimum safety requirements established in this section. Immediately thereafter, distribution of the sensitive altimeter conforming with the terms of this section may be started and continued.

(ii) The prescribed identification on the sensitive altimeter does not relieve the aircraft manufacturer or owner of responsibility for the proper application of the sensitive altimeter in his aircraft, nor waive any of the requirements concerning type certification of the aircraft in accordance with existing Civil Air Regulations.

(iii) If complaints of nonconformance with the requirements of this section are brought to the attention of the Civil Aeronautics Administration, and investigation indicates that such complaints are justified, the Administrator will take appropriate action to restrict the use of the product involved.

(iv) Copies of this Technical Standard Order and other Technical Standard Orders may be obtained from the Civil Aeronautics Administration, Aviation Information Staff, Washington 25, D. C.

[Supp. 5, 14 F. R. 3368]

§ 4b.691-9 *Technical Standard Order TSO-C16: "Air-Speed Tubes (Electrically Heated)" (CAA rules which apply to § 4b.691)*—(a) *Introduction.* (1) Electrically heated air-speed tubes are in the class of aircraft components which the Administrator of Civil Aeronautics is authorized to approve in accordance with Parts 4a and 4b of this subchapter.

(2) This Technical Standard Order is intended to serve as a criterion by which the product manufacturer can obtain Civil Aeronautics Administration approval of his electrically heated air-speed tube.

(3) In the establishment of this Technical Standard Order, consideration has been given to existing Government and industry standards for air-speed tubes for the purpose of adopting the performance requirements of one of the recognized aeronautical standards as the minimum safety requirements for air-speed tubes which are intended for use in civil aircraft. The specification of the Society of Automotive Engineers for electrically heated air-speed tubes contains such requirements.

(b) *Directive.*

(1) *Provision.* Pursuant to §§ 4a.31, 4a.550, 4b.41, and 4b.691 of this subchapter, which authorize the Administrator to approve aircraft equipment, the performance requirement for air-speed tubes as set forth in sections 5 and 6 of SAE Specification AS-393, Air-Speed Tubes, Electrically Heated, dated December 1, 1947,[1] stated below, are hereby established as minimum safety requirements for electrically heated air-speed tubes which are intended for use in civil aircraft.

1. *Purpose.* To specify minimum requirements for Electrically Heated Air Speed Tubes for use on aircraft the operation of which may subject the instrument to environmental conditions specified in section 3.4.

2. *Scope.* This specification covers the following basic types:

Type I. Pitot Pressure, Straight and L-shaped, 12 and 24 volt nominal, 2 wire circuit.

Type II. Pitot and Static Pressures, Straight and L-shaped 12 and 24 volt nominal, 2 wire circuit.

3. *General requirements.*

3.1 *Materials and workmanship.*

3.1.1 *Materials.* Materials shall be of a quality which experience and/or tests have demonstrated to be suitable and dependable for the purpose intended.

3.1.2 *Workmanship.* Workmanship shall be consistent with high grade instrument manufacturing practice.

3.2 *Radio interference.* The instrument shall not be the source of objectionable interference under operating conditions at any frequencies used on aircraft, either by radiation or feedback, in radio sets installed in the same aircraft as the instrument.

3.3 *Identification.* The following information shall be legibly and permanently marked on the units or attached thereto:

a. Name of instrument.
b. SAE Spec. AS 393.
c. Rating (Nominal Voltage).
d. Manufacturer's Part No.
e. Manufacturer's Serial No. or date of manufacture.
f. Manufacturer's name and/or trademark.

3.4 *Environmental conditions.* The following conditions have been established as design criteria only. Tests shall be conducted as specified in sections 5, 6, 7.

3.4.1 *Temperature.* When the instruments are mounted in accordance with manufacturer's instructions, they shall function over the range of ambient temperatures of −65° C to +70° C and shall not be adversely affected by exposure to temperatures of −65° C to +70° C.

3.4.2 *Vibration.* When the instruments are mounted in accordance with the manufacturer's instructions, they shall function and shall not be adversely affected when subjected to the following vibration:

Frequency: 500–3,000 cycles per minute.
Amplitude: 0.250 inch.
Maximum Acceleration: 32.5 g.

NOTE: It is understood that the unit shall withstand vibration at higher frequencies but the acceleration value need not exceed that shown above.

When specified by the purchaser for use in rotary wing aircraft, the frequency range shall be 150–3,000 cycles per minute.

4. *Detail requirements.*

4.1 *Drainage.* The tube shall be designed to provide maximum drainage of water, resulting from rain or melting ice, consistent with maintaining the calibration specified in sections 6.3, 6.4 and 6.5.

4.2 *Marking.* Pitot pressure and Static pressure lines shall be identified by the letters P and S, respectively, stamped, etched, engraved or otherwise permanently marked on the lines or fittings. The top of the tube shall be identified.

5. *Individual performance tests.* All instruments shall be subjected to whatever tests the manufacturer deems necessary to demonstrate specific compliance with the specification including the following requirements, where applicable.

5.1 *Leakage.* With a pressure of 10 inches of mercury applied separately to the pitot pressure and/or the static pressure lines, there shall be no evidence of leakage when the corresponding pitot or static pressure openings and drain holes are sealed.

5.2 *Dielectric.* The insulation shall withstand without evidence of damage the application of a sinusoidal voltage at a commercial frequency between the terminals of the heater circuit and the shell (case) for a period of 5 seconds. The R. M. S. value of the sinusoidal voltage applied shall be 500 volts.

5.3 *Heater operation.* When mounted in its normal position, the tube shall be tested for heater operation by applying the minimum rated voltage (12 or 24 volts) for a period of 2 minutes. The power consumption at that time shall be within ±30 percent of the power consumption at rated voltage.

6. *Qualification tests.* As many instruments as deemed necessary to demonstrate that all instruments will comply with the requirements of this section shall be tested in accordance with the manufacturer's recommendations, where applicable.

6.1 *Vibration.* The tubes shall be subjected to vibration for three hour periods in each of the three perpendicular reference planes such that a point on the tip of the tubes will oscillate ¼ inch. The test shall be conducted such that each period of three hours shall consist of one hour at 1,000, 2,000 and 3,000 cycles per minute. Rated voltage shall be applied to the terminals continuously during this test. Ambient temperature shall be 20° to 30° C. There shall be no failure of any kind.

6.2 *Endurance.* The tubes shall be made to operate continuously in still air at 15 or 30 volts (as applicable) for, at least, five hours. Ambient temperature shall be 70° C. There shall be no damage of any kind except discoloration, which will not affect corrosion resistance.

6.3 *Calibration at zero angle of attack.* The tube shall be mounted in a wind tunnel in line with the airflow and tested separately for pitot pressure and for static pressure at the values for air speeds specified in table I. The test shall be made by comparison with the results obtained under similar conditions with a calibrated tube. The error of the tube expressed in terms of indicated air speed shall not exceed 1 percent of the indication or 1 MPH, whichever is greater, and the static pressure shall be within the tolerances specified in table I.

TABLE I—PERMISSIBLE ERRORS IN STATIC PRESSURE

Indicated air speed m. p. h.:	*Tolerance inches of water*
50	0.10
75	.15
100	.20
125	.25
150	.30
175	.35
200	.40
225	.45
250	.50

6.4 *Calibration at various angles of attack.* The tube shall be tested as specified for "Error at Zero Angle of Attack" at approximately 125 MPH except that the angle of attack shall be varied by 2-degree intervals from +16 to −10 degrees inclusive. The indicated error expressed in terms of indicated air speed shall not differ from the indicated error at zero angle of attack by more than 3 miles per hour, and the error in static pressure shall not differ from the static pressure at zero angle of attack by more than 0.20 inch of water.

6.5 *Calibration at various angles of yaw.* The tube shall be tested as specified in section 6.3 at approximately 125 MPH except that the angle of yaw shall be varied between plus and minus five degrees. The indicated error expressed in terms of indicated air speed shall not differ from the error at zero angle of yaw by more than 3 miles per hour and the error in static pressure shall not differ from the static pressure at zero angle of yaw by more than 0.20 inch of water.

6.6 *Magnetic effect.* The magnetic effect of the tube shall be determined in terms of the deflection of a free magnet approximately 1½ inches long in a magnetic field with a horizontal intensity of 0.18±0.01 gauss, when the tube is held in various positions and with rated voltage applied on an east-west line with its nearest part five inches from the center of the magnet. (An aircraft Compass with the compensating magnets removed therefrom may be used as the free magnet for this test.) The Maximum deflection of the magnet shall not exceed 5 degrees for any pointer deflection.

6.7 *De-icing.* The tube shall be tested in an icing wind tunnel at a temperature of −10° to −20° C. and at an indicated tunnel air speed of 200 miles per hour. When the

[1] Copies may be obtained from the Society of Automotive Engineers, 29 West 39th St., New York, N. Y.

tube is coated with ¼ inch of ice at the nose, the minimum rated voltage shall be applied to the terminals. The time required to clear the ice cap shall not be more than 2 minutes after the potential is applied. No re-icing shall occur.

6.8 *Cold resistance.* The tube shall be subjected to a temperature of −65° C. or colder for a minimum period of 48 hours. There shall be no evidence of damage. After this test, the tube shall be capable of successfully passing all tests described heretofore.

(2) *Application.* (i) Air-speed tubes complying with the specifications appearing in this Technical Standard Order are hereby approved for all aircraft. Air-speed tubes already approved by the Administrator may continue to be installed in aircraft:

(*a*) For which an application for original type certificate is made prior to the effective date of this order,

(*b*) The prototype of which is flown within 1 year after the effective date of this order, and

(*c*) The prototype of which is not flown within 1 year after the effective date of this order if due to causes beyond the applicant's control.

(ii) If a major change is made in the installation within 9 months after the effective date of this order involving a change in type or model of air-speed tube, previously approved types of air-speed tubes may be installed. However, in any such change made after the 9-month period, new types of air-speed tubes installed in aircraft used in instrument flight shall meet the specifications contained herein.

(c) *Specific instructions.*

(1) *Marking.* In addition to the identification information required in the referenced specification, each air-speed tube shall be permanently marked with the Technical Standard Order designation "CAA-TSO-C16" to identify the air-speed tube as meeting the requirements of this order in accordance with the manufacturer's statement of conformance outlined below. This identification will be accepted by the Civil Aeronautics Administration as evidence that the established minimum safety requirements for air-speed tubes have been met.

(2) *Data requirements.* None.

(3) *Effective date.* After September 1, 1948, specifications contained in this Technical Standard Order will constitute the basis for Civil Aeronautics Administration approval of air-speed tubes for use in certificated aircraft used in instrument flight.

(4) *Deviations.* Requests for deviation from, or waiver of, the requirements of this order, which affect the basic airworthiness of the component, should be submitted for approval by the Director, Aircraft Service, Office of Aviation Safety, Civil Aeronautics Administration. These requests should be addressed to the nearest regional office of the Civil Aeronautics Administration, Attn: Superintendent, Aircraft Branch.

(5) *Conformance.* (i) The manufacturer shall furnish to the CAA, Aircraft Service, A-298, Washington 25, D. C., a written statement of conformance signed by a responsible official of his company, setting forth that the air-speed tube to be produced by him meets the minimum safety requirements established in this order. Immediately thereafter distribution of the air-speed tube conforming with the terms of this order may be started and continued.

(ii) The prescribed identification on the air-speed tubes does not relieve the aircraft manufacturer or owner of responsibility for the proper application of the air-speed tube in his aircraft, nor waive any of the requirements concerning type certification of the aircraft in accordance with existing Civil Air Regulations .

(iii) If complaints of nonconformance with the requirements of this order are brought to the attention of the Civil Aeronautics Administration, and investigation indicates that such complaints are justified, the Administrator will take appropriate action to restrict the use of the product involved.

(iv) Copies of this Technical Standard Order and other Technical Standard Orders may be obtained from the Civil Aeronautics Administration, Aviation Information Staff, Washington 25, D. C.

[13 F. R. 7733]

§ 4b.691-10 *Portable water - solution type fire extinguishers (CAA rules which apply to § 4b.691 (c)).* See § 4b.448-4.

[Supp. 4, 14 F. R. 3197]

INSTRUMENTS; INSTALLATION

GENERAL

§ 4b.696 *Arrangement and visibility of instrument installations.* (a) Flight, navigation, and power-plant instruments for use by each pilot shall be easily visible to him from his station with the minimum practicable deviation from his normal position and line of vision when he is looking out and forward along the flight path.

(b) All the required flight instruments shall be conveniently grouped and as nearly as practicable centered about the vertical plane of the pilot's forward vision.

(c) All the required power-plant instruments shall be closely grouped on the instrument panel. Identical power-plant instruments for the several engines shall be so located as to prevent any misleading impression as to the engines to which they relate. Important power-plant instruments shall be easily visible to the appropriate personnel.

§ 4b.697 *Instrument panel vibration characteristics.* The vibration characteristics of the instrument panel shall not be such as to seriously impair the accuracy of the instruments or to damage them.

FLIGHT AND NAVIGATION INSTRUMENTS

§ 4b.701 *Air-speed indicating system.* This system shall be so installed that the air-speed indicator shall indicate true air speed at sea level under standard conditions to within an allowable installational error of not more than plus or minus 3% or 5 miles per hour, whichever is greater, throughout the operating range of the airplane from 1.3 V_{s_1} (flaps up and down) to V_c. The calibration shall be made while in flight and the method used shall be subject to the approval of the Administrator.

§ 4b.702 *Air-speed indicator marking.* The air-speed indicator shall be marked as specified in § 4b.887.

§ 4b.703 *Static air vent system.* All instruments provided with static air case connections shall be vented to the outside atmosphere through a suitable piping system. Such vent(s) shall be so located on the airplane that its orifices will be least affected by air flow variation, moisture, or other foreign matter. The installation shall be such that the system will be airtight, except for the vent into the atmosphere.

§ 4b.704 *Magnetic direction indicator.* The magnetic direction indicator shall be so installed that its accuracy shall not be excessively affected by the airplane's vibration or magnetic fields of a permanent or transient nature. After the magnetic direction indicator has been compensated, the calibration shall be such that the deviation in level flight does not exceed plus or minus 10° on any heading. A suitable calibration placard shall be provided as specified in § 4b.888.

§ 4b.705 *Automatic pilot system.* If an automatic pilot system is installed, the following shall be applicable:

(a) The actuating (servo) devices shall be of such design that they can, when necessary, be either positively disengaged from operating the control system or be overpowered by the human pilot so as to enable him to maintain satisfactory control of the airplane,

(b) A satisfactory means shall be provided to readily indicate to the pilot the alignment of the actuating device in relation to the control system to which it operates, except when automatic synchronization is provided,

(c) The manually operated control(s) for the system's operation shall be readily accessible to the pilot,

(d) The automatic pilot system shall be of such design and so adjusted that, within the range of adjustment available to the human pilot, it cannot produce loads in the control system and surfaces greater than those for which they were designed.

§ 4b.705-1 *Technical Standard Order TSO-C9a: "Automatic Pilot" (CAA rules which apply to § 4b.705)*—(a) *Introduction.* (1) Automatic pilots are in the class of aircraft components which the Administrator of Civil Aeronautics is authorized to approve in accordance with Parts 3, 4a, and 4b of this subchapter.

(2) This Technical Standard Order is intended to serve as a criterion by which the product manufacturer can obtain Civil Aeronautics Administration approval of his automatic pilot.

(3) In the establishment of this Technical Standard Order, consideration has been given to existing Government and industry standards for automatic pilots for the purpose of adopting the performance requirements of one of the recognized aeronautical standards as the minimum safety requirements for automatic pilots which are intended for use in civil aircraft. The specification of the Society of Automotive Engineers for automatic pilots contains such requirements.

(b) *Directive.*

(1) *Provision.* Pursuant to §§ 3.31, 3.667, 4a.31, 4a.301, 4b.41, and 4b.705 of this subchapter, which authorize the Administrator to approve aircraft equipment, the performance requirements for automatic pilots as set forth in SAE Specification AS-402, Automatic Pilot, dated August 1, 1947,[1] stated below, are hereby established as minimum safety requirements for automatic pilots which are intended for use in civil aircraft:

1. *Purpose.* To specify minimum requirements for automatic pilots for use in aircraft, the operation of which may subject the instruments to the environmental conditions specified in section 3.4.

2. *Scope.* This specification covers all gyroscopic and servo control types of automatic pilots intended for use on aircraft to operate automatically the control surfaces of the aircraft to maintain a stabilized flight attitude with respect to the longitudinal, lateral and vertical axes, and to provide for maneuvering the airplane through servo control.

3. *General requirements.*

3.1. *Material and workmanship.*

3.1.1. *Materials.* Materials shall be of a quality which experience and/or tests have demonstrated to be suitable and dependable for aircraft instruments.

3.1.2. *Workmanship.* Workmanship shall be consistent with high grade aircraft instrument manufacturing practice.

3.2. *Radio interference.* The instrument shall not be the source of objectionable interference under operating conditions at any frequencies used on aircraft, either by radiation or feedback, in radio sets installed in the same aircraft as the instrument.

3.3. *Identification.* The following information shall be legibly and permanently marked on each of the major components or attached thereto.

(a) Name of the unit and type of automatic pilot.

(b) SAE Spec. AS 402.

(c) Rating (electrical or vacuum power supply and maximum servo output where applicable).

(d) Manufacturer's part number.

(e) Manufacturer's serial number or date of manufacture.

(f) Manufacturer's name and/or trademark.

3.4. *Environmental conditions.* The following conditions have been established as design criteria only. Tests shall be conducted as specified in sections 5, 6, and 7.

3.4.1. *Temperature.* When located in accordance with the instrument manufacturer's instruction, the units shall function over the range of ambient temperatures as listed in column A below and shall not be adversely affected by exposure to the temperature shown in column B below:

Instrument location	A	B
Power plant accessory compartment	−30° to 130° C.	−65° to 130° C.
Heated areas (temperature controlled)	−30° to 50° C.	−65° to 70° C.
Unheated areas (temperature uncontrolled)	−55° to 70° C.	−65° to 70° C.

3.4.2. *Humidity.* All units shall function and not be adversely affected when exposed to a relative humidity up to and including 95 percent at a temperature of approximately 32° C.

3.4.3. *Altitude.* All units shall function and not be adversely affected when exposed to a pressure and temperature range equivalent to −1,000 feet to 40,000 feet standard altitude, except as limited by application of section 3.4.1.

3.4.4. *Vibration.* When installed in accordance with instrument manufacturer's instructions, all units shall function and shall not be adversely affected when subjected to vibrations having characteristics likely to be encountered at the locations in the aircraft where the units are to be installed.

4. *Detail requirements.*

4.1. *Instrumentation.*

4.1.1. *Direction indication.* If aircraft direction indication is provided it shall be in accordance with AS 397 or AS 399.

4.1.2. *Bank and pitch indication.* If aircraft bank and/or pitch indication is provided it shall be in accordance with AS 396.

4.1.3. *Servo signal indication.* Means shall be provided to clearly indicate the magnitude and direction of servo signal present, except where automatic synchronization is provided. Then, yaw and roll signal need not be indicated. With the automatic pilot engaged, the pitch axis indication shall be representative of control surface load.

4.1.4. *Engagement indication.* Means shall be provided to clearly indicate whether the automatic pilot servos are in the engaged or disengaged position.

4.1.5. *System power indication.* Means shall be provided to permit operation of a device to indicate whether or not the instrument is receiving power.

4.1.6. *Servo power indication.* Means shall be provided to indicate when the servos are engaged but are not energized if such condition is possible.

4.1.7. *Caging indication.* Means shall be provided to indicate when the gyros are caged, except where it is not possible to leave them in a caged condition.

4.1.8. *Interlock indication.* The operation of any protective interlock device which renders any part of the system inoperative shall be indicated.

4.2. *Control range.*

4.2.1. *Corrective control.* The automatic pilot shall give stabilized control about the three axes throughout the following minimum ranges:

(a) Pitch ±50°.

(b) Roll ±75°.

(c) Yaw ±20°.

4.2.2. *Command control.* Means shall be provided to limit maneuvering the airplane, through the automatic pilot controls, to the following maximum ranges:

(a) Pitch ±30°.

(b) Bank ±45°.

(c) Turn=unlimited angle to the right or left.

4.3 *On-off control.* Means shall be provided, either electrical or mechanical, to permit the automatic pilot to be put in operation and to remove it from operation.

4.4. *Safety provisions.*

4.4.1. *Servo force.* Means shall be provided to limit the servo force to a safe value as determined in specific applications. The mounting base and housing of the servos shall be designed to withstand a load of 1.5 times the maximum output of the servo applied in a manner similar to that found in actual installation.

4.4.2. *Interlock provisions.* A means shall be provided to prevent the servo system from becoming operative until the automatic pilot is ready for operation.

4.4.3. *Indicator power source.* When the pitch and bank and/or azimuth units furnish an indicating reference, either directly or by repeaters, the automatic pilot shall be so designed that they become operative simultaneously with the turning on of the aircraft power source.

4.4.4. *Special features.* When special features are incorporated in the design of the automatic pilot (either integral or as accessories) they shall provide adequate interlocks, electrical and/or mechanical to prevent improper operation. For example:

(a) Coordinated turn control. Bank shall be limited.

(b) Altitude control. Pitch attitude correction shall be limited.

(c) Glide path control. Pitch attitude correction shall be limited.

4.4.5. *Servo disengaging means.* A positive mechanical means, independent of the aircraft power supply, shall be provided to disengage the servos from the aircraft control system. When the servos are disengaged, the manual control of the aircraft shall not be objectionably affected.

4.4.6. *Emergency release.* Means shall be provided for releasing the automatic control. The actuating device shall be suitable for mounting on the control wheel.

4.4.7. *Reliability.* Insofar as practicable, without affecting its normal operation, the automatic pilot design shall be such that should a failure occur in the system, no signal shall occur which would apply hazardous control to the airplane.

4.5. *Stability.* The roll, pitch and yaw signal sources shall establish the three axes about which the airplane is automatically controlled. The automatic pilot shall provide flight attitude stabilization, in smooth air, within 1 degree of selected attitude and heading about the above reference axes.

4.6. *Power variations.* All units shall properly function with a voltage and frequency variation of ±10% of the rated value (provided the A. C. voltage and frequency vary in the same direction), and/or ±30% of the rated vacuum or hydraulic pressure. Power variations beyond these limits shall not cause adverse control.

5. *Test Conditions.*

5.1. *Atmospheric conditions.* Unless otherwise specified, the tests shall be accomplished at atmospheric pressure of approximately 29.92 inches of mercury and at an ambient temperature of approximately 22° C. When tests are made with atmospheric pressure or temperature substantially different from these values, allowance shall be made for the difference from the specified conditions.

5.2. *Vibration (to minimize friction).* Unless otherwise specified, all tests for performance may be made with the instrument subjected to a vibration of 0.002 to 0.005 inch amplitude at a frequency of 1,500 to 2,000 cycles per minute. The term amplitude as used herein indicates the total displacement from positive maximum to negative maximum.

5.3. *Power conditions.* Unless otherwise specified all tests for performance shall be conducted at the power rating recommended by the manufacturer.

5.4. *Vibration stand.* A vibration stand shall be used which will vibrate at any desired frequency between 500 and 3,000 cycles per minute and shall subject the instrument to vibration such that a point on the instrument case will describe in a plane inclined 45 degrees to the horizontal plane, a circle, the diameter of which is equal to the amplitude specified herein.

6. *Individual performance tests.* All of the various units or complete system shall be tested in accordance with the manufacturer's recommendations. The manufacturer shall conduct sufficient tests to prove compliance with this specification, including the following requirements where applicable.

6.1. *Dielectric.* Insulation shall be subjected to a dielectric test with a R. M. S. voltage at a commercial frequency applied for a period of five seconds equivalent to five times normal circuit operating voltage except where circuits include condensers or other components for which such a test would be inappropriate; then the test voltage shall be 1.25 times circuit operating voltage. The insulation resistance shall not be less than 20 megohms at that voltage.

7. *Qualification tests.* As many instruments or components as deemed necessary to

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[1] Copies may be obtained from the Society of Automotive Engineers, 29 West 39th St., New York, N. Y.

demonstrate that all instruments will comply with the requirements of this section shall be tested in accordance with the manufacturer's recommendations.

7.1. *Low temperature operation.* Each component, or the complete system, after having been subjected to an ambient temperature of −30° C. or −55° C. as applicable (see par. 3.4.1) for a period of 5 hours, without operating, shall then meet the requirements of section 6 at that temperature.

7.2. *High temperature.* The requirements of section 7.1 shall apply except that the exposure temperature shall be 50° C., 70° C., or 130° C. as applicable (see par. 3.4.1).

7.3. *Extreme temperature exposure.* The instrument or components shall, after alternate exposures to ambient temperatures of −65° C. and 70° C. or −65° C. and 130° C. as applicable (see par. 3.4.1) for periods of 24 hours each and a delay of 3 hours following completion of the exposure, meet the requirements of section 6 at room temperature. There shall be no evidence of damage as a result of exposure to the extreme temperature specified herein.

7.4. *Magnetic effect.* Magnetic effect of the controller and all indicators shall be determined in terms of the deflection of a free magnet approximately 1½ inches long, in a magnetic field with a horizontal intensity of 0.18 (±.01) gauss when the units are held in various positions on an east-west line 12 inches from the center of the magnet. The maximum deflection of the magnet shall not exceed five degrees. Tests shall be made with instruments in power-on condition.

7.5. *Humidity.* The instrument shall be operated under the extreme condition specified in section 3.4.2 for a period of 10 hours after which it shall meet the requirements of section 6.

7.6. *Vibration.* The components shall be subjected to vibration with amplitudes of 0.005" to 0.063" as specified by the manufacturer at frequencies from 1,000 to 3,000 cycles per minute in order to determine that the natural frequency of the components does not lie in this frequency range. After three hours exposure to a vibration test recommended by the manufacturer, as per section 3.4.4, the instrument shall meet the requirements of section 6.

(c) *Application.* (i) Automatic pilots complying with the specifications appearing in this Technical Standard Order are hereby approved for all aircraft. Automatic pilots already approved by the Administrator may continue to be installed in aircraft:

(*a*) For which an application for original type certificate is made prior to the effective date of this order,

(*b*) The prototype of which is flown within 1 year after the effective date of this order, and

(*c*) The prototype of which is not flown within 1 year after the effective date of this order if due to causes beyond the applicant's control.

(ii) If a major change is made in the installation within 9 months after the effective date of this order involving a change in type or model of automatic pilot, previously approved types of automatic pilots may be installed. However, in any such change made after the 9-month period new type of automatic pilots installed in aircraft used in instrument flight shall meet the specifications contained herein.

(c) *Specific instructions.*

(1) *Marking.* In addition to the identification information required in the referenced specification, each automatic pilot shall be permanently marked with the Technical Standard Order designation "CAA-TSO-C9" to identify the automatic pilot as meeting the requirements of this order in accordance with the manufacturer's statement of conformance outlined below. This identification will be accepted by the Civil Aeronautics Administration as evidence that the established minimum safety requirements for automatic pilots have been met.

(2) *Data requirements.* None.

(3) *Effective date.* After July 1, 1948, specifications contained in this Technical Standard Order will constitute the basis for Civil Aeronautics Administration approval of automatic pilots for use in certificated aircraft used in instrument flight.

(4) *Deviations.* Requests for deviation from, or waiver of, the requirements of this order, which affect the basic airworthiness of the component, should be submitted for approval by the Director, Aircraft and Components Service, Office of Safety Regulation, Civil Aeronautics Administration. These requests should be addressed to the nearest regional office of the Civil Aeronautics Administration, Attn: Superintendent, Aircraft and Components Branch.

(5) *Conformance.* (i) The manufacturer shall furnish to the CAA, Aircraft and Components Service, A-298, Washington 25, D. C., a written statement of conformance signed by a responsible official of his company, setting forth that the automatic pilot to be produced by him meets the minimum safety requirements established in this order. Immediately thereafter distribution of the automatic pilot conforming with the terms of this order may be started and continued.

(ii) The prescribed identification on the automatic pilot does not relieve the aircraft manufacturer or owner of responsibility for the proper application of the automatic pilot in his aircraft, nor waive any of the requirements concerning type certification of the aircraft in accordance with existing Civil Air Regulations.

(iii) If complaints of nonconformance with the requirements of this order are brought to the attention of the Civil Aeronautics Administration, and investigation indicates that such complaints are justified, the Administrator will take appropriate action to restrict the use of the product involved.

(iv) Copies of this Technical Standard Order and other Technical Standard Orders may be obtained from the Civil Aeronautics Administration, Aviation Information Staff, Washington 25, D. C.

[13 F. R. 3855, 7734]

§ 4b.706 *Gyroscopic indicators (air-driven type).* All air-driven gyroscopic instruments installed shall derive their energy from a suction air pump driven either by an engine or an auxiliary power unit. The following detail requirements shall be applicable:

(a) Two suction air pumps actuated by separate power means shall be provided, either one of which shall be of sufficient capacity to operate, at the service ceiling of the airplane in normal cruising condition, all of the air-driven gyroscopic instruments with which the airplane is equipped.

(b) A suitable means shall be provided in the attendant installation, where the pump lines connect into a common line, to select either suction air pump for the proper functioning of the instruments should failure of one source or a breakage of one pump line occur. When an automatic means to permit simultaneous air flow is provided in the system, a suitable method for indicating any interrupted air flow in the pump lines shall be incorporated in the system. In order to indicate which source of energy has failed, a visual means shall be provided to indicate this condition to the flight crew.

(c) A suction gauge shall be provided and so installed as to indicate readily to the flight crew while in flight, the suction in inches of mercury which is being applied to the air-driven types of gyroscopic instruments. Such gauge(s) shall be connected to the instruments by a suitable system.

POWER-PLANT INSTRUMENTS

§ 4b.711 *Operational markings.* Instruments shall be marked as specified in § 4b.889.

§ 4b.712 *Instrument lines.* Power-plant instrument lines shall comply with the provisions of § 4b.516. In addition, instrument lines carrying inflammable fluids or gases under pressure shall be provided with restricted orifices or equivalent safety devices at the source of the pressure to prevent escape of excessive fluid or gas in case of line failure. (For fire-resistant power-plant instrument lines see §§ 4b.654 and 4b.655.)

§ 4b.713 *Fuel quantity indicator.* Means shall be provided to indicate to the flight personnel the quantity in gallons or equivalent units of usable fuel in each tank during flight. Tanks whose outlets and air spaces are interconnected may be considered as one tank and need not be provided with separate indicators. Exposed sight gauges shall be so installed and guarded as to prevent breakage or damage. Fuel quantity indicators shall be calibrated to read zero during level flight when the quantity of fuel remaining in the tank is equal to the unusable fuel supply as defined by § 4b.494. (See § 4b.891.)

§ 4b.714 *Fuel flowmeter system.* When a fuel flowmeter system is installed in the fuel line(s), the metering component shall be of such design as to include a suitable means for bypassing the fuel supply in the event that malfunctioning of the metering component offers a severe restriction to fuel flow.

§ 4b.715 *Oil quantity indicator.* Ground means, such as a stick gauge, shall be provided to indicate the quantity of oil in each tank. (See § 4b.890.) If an oil transfer system or a reserve oil supply system is installed, means shall be provided to indicate to the flight personnel the quantity of oil in each tank during flight.

§ 4b.716 *Cylinder head temperature indicating system for air-cooled engines.* A cylinder head temperature indicator shall be provided for each engine on airplanes equipped with cowl flaps. In the case of airplanes which do not have cowl flaps, an indicator shall be provided if compliance with the provisions of §§ 4b.571–4b.595 is demonstrated at a speed in excess of the speed of best rate of climb.

ELECTRICAL SYSTEMS AND EQUIPMENT

§ 4b.721 *Installation.* (a) Electrical systems and equipment shall:

(1) Be free from hazards in themselves, in their method of operation, and in their effects on other parts of the airplane;

(2) Be installed in such a manner that they are suitably protected from fuel, oil, water, other detrimental substances, and mechanical damage.

(b) In addition to the requirements specified, all electrical equipment shall be of a type and design adequate for the use intended. For substantiation of the electrical system the data required under § 4b.16 is considered to include:

(1) Wiring diagrams, including a schematic power supply diagram.

(2) Installation data which includes the manufacturer's name and type of all electrical items and reference to pertinent specifications.

(3) A load analysis.

(c) Items of electrical equipment for specific types of airplane operations are listed in Part 41 entitled "Certification and Operation Rules for Scheduled Operations Outside the Continental Limits of the United States" and Part 61 entitled "Scheduled Air Carrier Rules," of this subchapter.

BATTERIES

§ 4b.726 *Capacity.* The capacity shall be that determined necessary from an electrical load analysis.

§ 4b.727 *Protection against acid.* Means shall be provided to prevent corrosive battery substance from coming in contact with other parts of the airplane during servicing or flight.

§ 4b.728 *Battery containers.* Batteries shall be completely enclosed in a container or compartment and shall be easily accessible for servicing and inspection on the ground.

§ 4b.729 *Battery vents.* The battery container or compartment shall be vented in such a manner that gases released by the battery are carried outside the airplane.

§ 4b.730 *Battery cooling.* Battery cooling shall be provided, if necessary, to keep the battery temperature within the limits specified by the battery manufacturer.

GENERATORS

§ 4b.736 *Capacity.* The capacity necessary shall be determined initially from an electrical load analysis and its adequacy shall be demonstrated during flight test. A switch shall be provided for each generator to permit its output to be interrupted.

§ 4b.737 *Generator rating.* Individual generators shall be capable of delivering their continuous rated power.

§ 4b.738 *Generator controls.* Generator voltage control equipment shall be capable of dependably regulating the generator output within rated limits.

§ 4b.739 *Reverse current cut-out.* A generator reverse current cut-out shall disconnect the generator from the battery and other generators when the generator is developing a voltage of such value that current sufficient to cause malfunctioning can flow into the generator.

MASTER SWITCH

§ 4b.741 *Arrangement.* A master switch arrangement shall be provided which will disconnect all sources of electrical power from the main distribution system at a point adjacent to the power sources.

§ 4b.742 *Installation.* The master switch or its controls shall be so installed that it is easily discernible and accessible to a member of the crew in flight.

PROTECTIVE DEVICES

§ 4b.746 *Fuses or circuit breakers.* Protective devices (fuses or circuit breakers) shall be installed in the circuits to all electrical equipment except that such items need not be installed in the main circuits of starter motors or in other circuits where no hazard is presented by their omission.

§ 4b.747 *Protective devices installation.* Protective devices in circuits used in flight shall be so located and identified that fuses may be replaced or circuit breakers reset readily in flight.

§ 4b.748 *Spare fuses.* If fuses are used, one spare of each rating or 50% spare fuses of each rating, whichever is greater, shall be provided.

ELECTRIC CABLES

§ 4b.751 *Electric cables.* The electrical cable used shall be in accordance with approved standards for aircraft electric cable of a slow burning type and shall have adequate current carrying capacity to deliver the necessary power to the items of equipment to which it is connected.

SWITCHES

§ 4b.756 *Capacity.* Switches shall be capable of carrying their rated current.

§ 4b.757 *Installation.* Switches shall be so installed as to be readily accessible to a member of the crew and shall be suitably labeled as to operation and the circuit controlled.

INSTRUMENT LIGHTS

§ 4b.761 *Intensity.* Instrument lights shall provide sufficient illumination to make all instruments, switches, etc., easily readable and discernible.

§ 4b.762 *Installation.* Instrument lights shall be installed in such a manner that their direct rays are shielded from the pilot's eyes and that no objectional reflections are visible to him.

§ 4b.763 *Light dimming.* A suitable means of controlling the intensity of illumination shall be provided unless it can be shown that nondimmed instrument lights are satisfactory.

LANDING LIGHTS

§ 4b.766 *Type.* Landing lights shall be of a type acceptable to the Administrator.

§ 4b.767 *Landing light installation.* Landing lights shall be so installed that there is no objectionable glare visible to the pilot and also that the pilot is not seriously affected by halation. They shall be installed at such a location that they provide adequate illumination for night landing.

§ 4b.768 *Landing light switch.* A switch for each light shall be provided, except that where multiple lights are installed at one location, a single switch for the multiple lights is satisfactory.

POSITION LIGHTS

§ 4b.771 *Type.* Forward and rear position lights shall be of a type certificated in accordance with Part 15 of this chapter.

§ 4b.772 *Forward position light installation.* Forward position lights shall be so installed that, with the airplane in normal flying position, the red light is displayed on the left side and the green light on the right side, each showing unbroken light between two vertical planes whose dihedral angle is 110 degrees when measured to the left and right, respectively, of the airplane from dead ahead. The lights shall be spaced laterally as far apart as practicable.

§ 4b.773 *Rear position light installation.* The red and white position lights shall be mounted as far aft as practicable and so installed that unbroken light is directed symmetrically aft from each light in such a manner that the axis of the maximum cone of illumination is parallel to the flight path. In addition, the intersection of the two planes forming dihedral angle A given in Part 15 of this subchapter shall be vertical. If separate red and white lights are used, they shall be located as close together as practicable.

§ 4b.774 *Top and bottom fuselage lights.* The top and bottom fuselage lights shall each furnish illumination of an intensity equivalent to that of a 32-candlepower lamp installed in a reflector of relatively high reflective properties and shall have a clear cover glass. They shall show light through approximately a hemisphere.

§ 4b.775 *Top and bottom fuselage lights; installation.* The top fuselage light shall be installed in the top of the fuselage approximately in line with the forward position lights. The bottom fuselage light on landplanes shall be installed in the bottom of the fuselage approximately in line with the forward position lights. In the case of seaplanes the location of the bottom light will be subject to specific approval on each model airplane.

§ 4b.776 *Position light flasher.* The position light flasher shall incorporate two flashing circuits which are energized alternately to provide flashing of the position and fuselage lights in the manner indicated below. The flasher shall be of a type acceptable to the Administrator.

§ 4b.776-1 *Technical Standard Order TSO-C18: "Position Light Flashers" (CAA rules which apply to § 4b.776)*—(a) *Introduction.* Under section 601 of the Civil Aeronautics Act of 1938, as amended, and §§ 4a.31, 4a.578, 4b.41, and 4b.776 of this chapter, the Administrator of Civil Aeronautics is authorized to adopt standards for position light flashers intended for use on civil aircraft. In adopting these standards, consideration has been given to existing Government and industry standards for position light flashers.

(b) *Directive*—(1) *Provision.* (i) The performance requirements for position light flashers, as set forth in sections 3.3, 3.4 (except 3.4.2) 4 (except 4.4 and 4.5) and 5 of SAE Specification AS-211, "Flasher, Position Light" dated November 1, 1948,[1] stated below, are hereby established as minimum safety performance standards for position light flashers intended for use on civil aircraft:

1. *Purpose.* To specify minimum requirements for aircraft position light flashers, the operation of which may subject the flasher to the environmental conditions specified in section 3.3.

2. *Scope.* This specification covers two types of position light flashers:

Type I: For nominal 24 volt d. c. systems.

Type II: For nominal 12 volt d. c. systems.

3. *General requirements.*

3.1 *Materials and workmanship.*

3.1.1 *Materials.* Materials shall be of a quality which experience and/or tests have demonstrated to be suitable and dependable for the purpose intended.

3.1.2 *Choice of materials.* Choice and treatment of materials shall be such as to eliminate or minimize:

1. Corrosion.
2. Fire hazard.
3. Fungus growth.

3.1.3 *Workmanship.* Workmanship shall shall be consistent with high-grade aircraft electrical equipment practice.

3.2 *Identification.*

3.2.1 *Nameplate.* The following informamation shall be legibly and permanently marked on the unit or attached thereto:

a Name of unit (position light flasher).
b. SAE specification AS211.
c. Voltage.
d. Normal motor current—amps.
e. Flasher contact capacity—amps.
f. Manufacturer's part number.
g. Manufacturer's serial number—(date of manufacture, optional).
h. Manufacturer's name and/or trademark.

3.2.2 *Wiring daigram.* A diagram of the internal wiring of the flasher shall be legibly marked on the unit or attached thereto.

3.3 *Environmental conditions.* The complete unit shall operate under the following environmental conditions and shall meet the following performance requirements:

3.3.1 *Temperature.* When mounted in accordance with the maufacturer's recommendations, the unit shall function over the range of ambient temperature from −35° C to +55° C. It shall not be adversely affected by exposure to temperatures in the range of −65° C to +70° C.

3.3.2 *Humidity.* The unit shall function and shall not be adversely affected by exposure to a relative humidity in the range of 5% to 90% throughout a temperature range of −35° C to +55° C.

3.3.3 *Altitude.* The unit shall function and shall not be adversely affected when subjected to a pressure and temperature range equivalent to −1000 feet to +25,000 feet standard altitude.

3.3.4 *Vibration.* The unit shall function and shall not be adversely affected when subjected to vibration of 0.060 inch double amplitude at from 600 to 3300 cycles per minute when tested complete with its bracket and/or shock mounts and with the direction of vibration perpendicular to its normal mounting surface.

3.3.5 *Dust.* The instrument shall function and shall not be adversely affected when subjected to severe sand and dust conditions.

3.3.6 *Salt spray.* The instrument shall function and shall not be adversely affected when subjected to a salt spray for a period of 100 hours.

3.4 *Radio interference.*

3.4.1 *Radio interferenee.* The flasher motor shall not be the source of objectionable interference under operating conditions, at any frequencies used on the aircraft, either by radiation or feed back, in radio sets installed in the same aircraft as the flasher. The flasher case shall be electrically continuous and shall be grounded to the aircraft structure.

3.4.2 *Interference suppression.* The motor circuit shall be provided with the necessary radio interference suppression features to suppress its radio interference to the limits set forth herein for conducted and radiated radio interference. In particular, these features shall include adequate filters and inclosing case construction which will prevent interference leakage through it or through joints, seams, and mating surfaces. The volume and weight of filtering equipment required shall be minimized by the application of proper electrical and mechanical design and construction.

3.4.3 *Conducted radio interference limits.* The conducted radio interference voltage produced by operation of the equipment on wiring connected to or associated with the equipment, when measured between each terminal and the ground plane, shall not exceed 200 microvolts over the frequency range of 0.15 to 0.2 of a megacycle and 50 microvolts over the frequency range of 0.2 to 20 megacycles.

3.4.4 *Radiated radio interference.* The radio interference field produced by operation of the equipment when measured with the rod or dipole antenna of the measuring instrument placed in various positions one foot from the equipment and interconnecting cable assemblies, shall not exceed the microvolt values shown in the following table:

Frequency band Mcs.:	*Microvolts*
0.15–65.0	2.5
65.0–100.0	5.0
100.0–150.0	10.0

4. *Detail requirements.*

4.1 *Input voltage.* The flasher shall perform under all conditions outlined herein, over these input voltages:

Type I: 22 to 28.5 volts d. c.

Type II: 11 to 14.5 volts d. c.

4.2 *Flashing cycle and accuracy.* The flashing cycle shall be repeated 40±4 times per minute. Each cycle shall be as follows:

Wing tip and white tail light "ON"	130°
Dark	50°
Top and bottom fuselage lights and red tail light "ON"	130°
Dark	50°

A maximum deviation of 5° from these periods is permissible.

4.3 *Current carrying capacity.* Flashing light circuits shall be capable of operating lamp loads having total values as follows:

Type I flasher: 3.0 amps.

Type II flasher: 6.0 amps.

They shall satisfactorily handle the inrush currents of the position lights they are to flash.

4.4 *Motor power consumption.* Normal Power Consumption of the motor circuit shall be no more than 10 watts.

4.5 *Life.* The flasher shall operate 500 hours with no adjustment or replacement of parts and shall operate 1,000 hours with no repair other than the replacement of the contacts in the light circuits.

5. *Individual performance requirements.*

5.1 *Individual performance test.* Each flasher unit, before shipment shall be operated at room ambient conditions to assure that it meets the requirements of 4.2 above over the whole range of input voltages specified in 4.1. It shall also be subjected to an insulation resistance test before any internal circuits to ground are completed to assure its freedom from shorts, grounds, etc. Resistance shall not be less than 10 megohms.

(ii) For the purposes of this order, the terms "motor" and "the flasher motor" contained in sections 3.2.1 and 3.4.1 of AS-211, shall be interpreted to mean any type of actuating mechanism.

(2) *Application.* (i) Position light flashers complying with the specifications appearing in this order are hereby approved for all aircraft. Position light flashers already approved by the Administrator may continue to be installed in aircraft:

(*a*) For which an application for original type certificate is made prior to the effective date of this order,

(*b*) The prototype of which is flown within one year after the effective date of this order, and

(*c*) The prototype of which is not flown within one year after the effective date of this order if due to causes beyond the applicant's control.

(ii) If an alteration involving a change in type or model of position light flasher is made within nine months after the effective date of this order, previously approved types of position light flashers may be installed. However, in any such change made after the nine-month period, new types of position light flashers installed on aircraft used in scheduled air carrier operation shall meet the specifications contained herein.

(c) *Specific instructions*—(1) *Marking.* In addition to the identification information required in the referenced specification, each position light flasher shall be permanently marked with the Technical Standard Order designation, CAA-TSO-C18 to identify the position light flasher as meeting the requirements of this order in accordance with the manufacturers' statement of conformance outlined below. This identification will be accepted by the Civil Aeronautics Administration as evidence that the established minimum safety requirements for position light flasher have been met.

(2) *Data requirements.* Ten copies of installation, operating, and maintenance recommendations or instructions shall be submitted by the manufacturer of the position light flasher with his statement of conformance to the Civil Aeronautics Administration, Aircraft Service, Attn: A-298, Washington 25, D. C.

(3) *Effective date.* After May 1, 1949, specifications contained in this order will constitute the basis for Civil Aeronautics Administration approval of position light flashers for use on certificated aircraft used in scheduled air carrier operation.

(4) *Deviations.* Requests for deviation from, or waiver of, the requirements

[1] Copies may be obtained from the Society of Automotive Engineers, 29 West 39th St., New York, N. Y.

of this order, which affect the basic airworthiness of the component, should be submitted for approval by the Director, Aircraft Service, Office of Aviation Safety, Civil Aeronautics Administration. These requests should be addressed to the nearest Regional Office of the Civil Aeronautics Administration, Attn: Superintendent, Aircraft Branch.

(5) *Conformance.* (i) The manufacturer shall furnish to the CAA, Aircraft Service, A-298, Washington 25, D. C., a written statement of conformance signed by a responsible official of his company, setting forth that the position light flasher to be produced by him meets the minimum safety requirements established in this order. Immediately thereafter distribution of the position light flasher conforming with the terms of this order may be started and continued.

(ii) The prescribed identification of the position light flasher does not relieve the aircraft manufacturer or owner of responsibility for the proper application of the position light flasher on his aircraft, nor waive any of the requirements concerning type certification of the aircraft in accordance with existing Civil Air Regulations.

(iii) If complaints of nonconformance with the requirements of this order are brought to the attention of the Civil Aeronautics Administration, and investigation indicates that such complaints are justified, the Administrator will take appropriate action to restrict the use of the product involved.

(iv) Copies of this Technical Standard Order and other Technical Standard Orders may be obtained from the Civil Aeronautics Administration, Aviation Information Staff, Washington 25, D. C.

[Supp. 4, 14 F. R. 3197]

§ 4b.777 *Flashing light sequence.* The forward position lights and the rear white position light shall be on one of the flasher circuits, and the top and bottom fuselage lights and the rear red position light shall be on the other. The flashing sequence shall be repeated automatically when the position light switch is in the "flash" position.

§ 4b.778 *Flashing light cut-out switch.* A switch shall be provided to eliminate the flasher from the position light circuit so that continuous light may be provided by the forward position lights and the rear white position light. The top and bottom fuselage lights shall not be lighted under this condition.

RIDING LIGHT

§ 4b.781 *Standards.* When a riding light is required, seaplanes, flying boats, and amphibians shall have at least one riding (anchor) light, which is capable of showing a white light for at least two miles at night under clear atmospheric conditions.

§ 4b.782 *Installation.* The riding light shall be so installed that it shows the maximum unbroken light practicable when the airplane is moored or drifting on the water. Externally hung light(s) are permitted.

SAFETY EQUIPMENT; INSTALLATION

§ 4b.791 *Marking.* Safety equipment controls which the crew is expected to operate at the time of an emergency such as flares, automatic life raft releases, etc., shall be readily accessible and plainly marked as to the method of operation. When fire extinguishing, life enduring, and signaling equipment is carried in lockers, compartments, etc., such storage places shall be marked for the benefit of passengers and crew.

DE-ICERS

§ 4b.796 *Installation.* When pneumatic de-icers are installed, the installation shall be in accordance with approved data. Positive means shall be provided for the deflation of the pneumatic boots.

FIRE EXTINGUISHERS

§ 4b.799 *Number and installation.* (a) The approved hand-type fire extinguisher required in § 4b.691 (c) shall be installed primarily for the use of the pilot and copilot. The installation of the additional fire extinguishing equipment required in Parts 41 and 61 of this subchapter will depend upon the size and type of the aircraft and the disposition and size of the crew and passengers and location of such fire extinguishers used will be subject to the approval of the Administrator.

(b) An approved fire extinguisher is one approved by the Underwriters' Laboratories or by any other agency deemed qualified by the Administrator.

FLARES

§ 4b.801 *Flare requirements.* When parachute flares are required, they shall be of a type certificated in accordance with Part 15 of this subchapter.

§ 4b.802 *Flare installation.* Parachute flares shall be releasable from the pilot compartment and so installed that danger from accidental discharge is reduced to a minimum. It shall be demonstrated in flight that the installation in each model of airplane is such that ejection is accomplished without any hazard to the airplane or its occupants. If the flares are ejected so that recoil loads are involved, structural provision for such loads shall be made.

SAFETY BELTS AND SIGNAL

§ 4b.806 *Type.* Safety belts shall be of a type certificated in accordance with Part 15 of this subchapter. They shall be so attached that no part of the attachment will fail at a lower load than that specified in § 4b.443 (b).

§ 4b.807 *Safety belt signal.* When a means is provided to indicate to the passengers when the seat belt should be fastened, the device shall be so installed that it can be operated from the seat of either pilot or copilot.

EMERGENCY FLOTATION AND SIGNALING EQUIPMENT

§ 4b.811 *General.* When required by Parts 40, 41, and 61 of this subchapter, an approved life raft or approved life preserver is one approved by either the Administrator, the Bureau of Marine Inspection and Navigation, the U. S. Army Air Forces, or the Bureau of Aeronautics, Navy Department.

§ 4b.811-1 *Technical Standard Order TSO-C12: "Life Rafts" (CAA rules which apply to § 4b.811)*—(a) *Introduction.* (1) Life rafts are in the class of aircraft components which the Administrator of Civil Aeronautics is authorized to approve in accordance with Parts 3, 4a, and 4b of this subchapter.

(2) This Technical Standard Order is intended to serve as a criterion by which the product manufacturer can obtain Civil Aeronautics Administration approval of his life raft.

(3) In the establishment of this Technical Standard Order, consideration has been given to existing Government and industry standards for life rafts for the purpose of adopting the performance requirements of one of the recognized aeronautical standards as the minimum safety requirements for life rafts which are intended for use in civil aircraft. The specification of the National Aircraft Standards Committee for life rafts contains such requirements.

(b) *Directive.*

Provision. Pursuant to §§ 3.31, 3.716, 4a.31, 4a.525, 4a.537, 4b.41, and 4b.811 of this subchapter, which authorize the Administrator to approve aircraft equipment, including life rafts, the performance requirements for life rafts as set forth in National Aircraft Standards Specification NAS 800, Airline Life Rafts, dated November 19, 1947,[1] stated below, are hereby established as minimum safety requirements for life rafts which are intended for use in civil aircraft:

1. *Applicable specifications.*

1.1 The following specifications shall by references hereinafter noted form a part of this specification.

1.1.1 *U. S. Army Specifications.* U. S. Army Spec. 94-40420A Raft, Pneumatic Type A-3A.

2. *Type and grade.*

2.1 This specification covers minimum performance and safety requirements for all types of airline life rafts suitable for commercial transoceanic use.

3. *Materials and workmanship.*

3.1 *Fabric material.* Rubberized fabric used in the construction of the air tubes shall have the following physical characteristics:

Tensile strength (Grab Test) Warp 190 lbs. per inch (Min.). Filler 190 lbs. per inch (Min.).

Tear (Trapezoidal Method): 12 x 12 lbs. per inch (Min.).

Permeability: 10 liters 24 hrs. (Max.)

The ply or coat adhesion of the fabric shall not be less than 3.5 lbs. per square inch. Fabrics used in bottoms, canopy, spray shield, etc., shall be suitable for the purpose intended.

3.2 *Protection.* All metal parts shall be corrosion resistant or suitably protected against corrosion. All cotton material, ropes and twine shall be mildew proofed.

4. *Detail requirement.*

4.1 *Design and construction.*

4.1.1 *Shape.* The raft shall be circular in shape.

4.1.2 *Size.* The following dimensions shall determine the size of raft:

10 man—Inside diameter of raft: 6 ft. 6 in.

[1] Copies may be obtained from the American Aeronautical Forum, 506 Washington Loan and Trust Building, Washington 4, D. C.

15 man—Inside diameter of raft: 8 ft.
20 man—Inside diameter of raft: 10 ft.

4.1.3 *Number of tubes.* The raft shall have two identical air tubes, one superimposed on the other.

4.1.4 *Floor.* The raft shall have a center type floor (suspended from between tubes), with manually inflated blister on each side in the center.

4.1.5 *Buoyancy.* The minimum buoyancy per person shall be 250 pounds, based on the two tubes only (disregarding the buoyancy derived from the floor or the inflatable floor support). Minimum free-board shall be 12 inches for all rafts herein considered, utilizing buoyancy of the complete raft allowing 165 pounds per person. Not less than 85% of each tube should be CO_2 inflated (boarding station tubes are manually inflated with air).

4.1.6 *Inflation.* Both tubes inflated by CO_2 equipment to a pressure of not less than 1 psi and not more than 1½ psi at a corrected temperature of 70° F. and at corrected standard atmospheric pressure. Inflation equipment shall be located on outside periphery of raft. The CO_2 release mechanism shall be suitably identified and protected by a conspicuous warning flap or tab which must be unfastened to permit actuation of the release device. Arrangement shall be such that failure of one tube or manifold will not allow loss of gas in second tube. Any manifold system shall permit equal distribution of gas to the individual tubes. No sealing material which will harden or obstruct the gas passage shall be used.

4.1.7 *Bulkheads.* None required except at boarding stations.

4.1.8 *Boarding stations.* One boarding station shall be provided in each tube and shall consist of a section of tube (minimum length of 30″) to be manually inflated from either side of raft. Locations of boarding stations shall not impair rigidity of raft.

4.1.9 *Boarding handles.* Boarding handles shall be suitably located at each boarding station to best assist persons entering the raft from the water. They shall be designed to withstand a pull of 250 lbs. per handle.

4.1.10 *Life line.* A life line of webbing, ¼ inch cotton rope (or equivalent), shall encircle the raft on the outside periphery. It shall be usable with the raft floating either side up. It shall be attached to the raft at intervals by means of knots at the webbing loops (or equivalent).

4.1.11 *Manual inflation valves.* Shall be located so as to permit pump inflation of both tubes from either side. Must not interfere with occupant comfort.

4.1.12 *Color.* All exposed surfaces shall be yellow, conforming to Shade No. 120 of Supplement to Specification #3-1 (U. S. Army Spec. Ref. Sect. E-2 of Spec. #94,-40420A) or superior high visibility color.

4.2 *Accessory equipment.*

4.2.1 *Raft lanyard.* A suitable lanyard of not less than 5/16″ diameter cotton rope (or equivalent) with a minimum length of 20 feet shall be provided. One end shall be attached to the raft at tube intersection with the rest of the line held coiled (or looped) at that point. Provision shall be made for attaching the loose end of the lanyard to the outside of the carrying case or container so that the lanyard may be secured to the plane when the raft is put overboard.

4.2.2 *Sea anchor.* A 16″ diameter sea anchor shall be provided suitably attached to 25 feet of 3/16″ cotton braided line (or equivalent). A point of attachment of suitable strength (not less than 250 lbs.) for the attachment of a sea anchor shall be provided on the tube intersection line diametrically opposite the point of attachment of the raft lanyard.

4.2.3 *Heaving line.* One heaving line (British type or equivalent) shall be located on the outside periphery of the raft so as to be accessible from either side. It shall be mounted near one of the boarding stations. The heaving line and ring shall be designed so as to float on the surface of the water.

4.2.4 *Canopy.* An overall cover shall be provided leaving provisions for opening for two-way cross-ventilation. It shall be easily detachable from periphery of raft. It shall be attached to the periphery of the raft in such a manner as to be usable from either side. Provisions shall be made for supporting the canopy above the heads of the occupants. Material should be light weight, waterproof, non-odorous, and of same color as raft. A closable outlet shall be provided at the center of the canopy to permit controlled trapping of rain water by raft occupants if desired.

4.2.5 *Paddles.* Two paddles, each in two sections, and each 4 feet long (when assembled) shall be provided. The paddles shall be in accordance with or equal to the latest revision of applicable Army or Navy Specifications for Oars; Sectional (Aircraft Use) insofar as materials, strength, general design and finish are concerned. The paddles shall be attached to the raft with suitable rope to prevent loss and stowed to permit easy access and compact raft packing.

4.2.6 *Inflation pump.* The pump shall be in accordance with or equal to the latest revision of the applicable Army-Navy specification for Pumps; Hand Air, insofar as materials, strength, general design and finish are concerned. One pump shall be provided, tied with suitable rope to raft to prevent loss. Stowage shall permit easy access and compact raft packing.

4.2.7 *Accessory case tie-downs.* Provisions shall be made on each side of the floor at center of raft for tie-downs to hold the accessory case. Each tie-down shall be capable of withstanding a pull of 250 pounds.

4.3 *Marking instructions.*

4.3.1 *Raft identification.* Each raft shall be legibly and permanently marked with the following information:

a. Manufacturer's Name.

b. Manufacturer's Model and Serial Number.

c. National Aircraft Standard Number (NAS 800).

4.3.2 *Placarding instructions.* Suitable placarding in waterproof black ink (or equivalent) shall denote use and location of raft equipment. Placarding shall take into account possible occupancy of either side of raft as well as persons boarding raft from water.

4.4 *Tests.*

4.4.1 *Pressure test.* Rafts shall withstand an inflation pressure of 6 psi for not more than 10 minutes when new. This test is a check on workmanship, design and seam construction and shall be applied at the manufacturers' plant to occasional rafts selected at random or as otherwise directed by the purchaser.

4.4.2 *Leakage test.* All rafts shall be inflated through the manifold to 2 psi and left for 24 hours. The pressure shall not drop below 1 psi at the end of 24 hours with suitable correction for temperature changes. This test is to be made at the manufacturer's plant.

5. *Notes.*

5.1 The requirements of this specification are based upon Air Transport Association (ATA) Life Raft Recommendation 1-B.

(c) *Application.* (i) Life rafts complying with the specifications appearing in this Technical Standard Order are hereby approved for all aircraft. Life rafts already approved by the Administrator may continue to be installed in aircraft:

(*a*) For which an application for original type certificate is made prior to the effective date of this order,

(*b*) The prototype of which is flown within 1 year after the effective date of this order, and

(*c*) The prototype of which is not flown within 1 year after the effective date of this order if due to causes beyond the applicant's control.

(ii) If a major change is made in the installation within 9 months after the effective date of this order involving a change in type or model of life raft, previously approved types of life rafts may be installed. However, in any such change made after the 9-month period, new types of life rafts installed in aircraft engaged in over-water operations shall meet the specifications contained herein.

(c) *Specific instructions.*

(1) *Marking.* In addition to the identification information required in the referenced specification, each life raft shall be permanently marked with the Technical Standard Order designation, "CAA-TSO-C12," to identity the life raft as meeting the requirements of this order in accordance with the manufacturer's statement of conformance outlined below. This identification will be accepted by the Civil Aeronautics Administration as evidence that the established minimum safety requirements for life rafts have been met.

(2) *Data requirements.* None.

(3) *Effective date.* After August 1, 1948, specifications contained in this order will constitute the basis for Civil Aeronautics Administration approval of life rafts for use in certificated aircraft engaged in over-water operations.

(4) *Deviations.* Requests for deviation from, or waiver of, the requirements of this order, which affect the basic airworthiness of the component, should be submitted for approval by the Director, Aircraft Service, Office of Aviation Safety, Civil Aeronautics Administration. These requests should be addressed to the nearest regional office of the Civil Aeronautics Administration, Attn: Superintendent, Aircraft Branch.

(5) *Conformance.* (i) The manufacturer shall furnish to the Civil Aeronautics Administration, Aircraft Service, Attn: A-298, Washington 25, D. C., a written statement of conformance signed by a responsible official of his company, setting forth that the life rafts to be produced by him meet the minimum safety requirements established in this order. The statement of conformance should specify which size life rafts are being produced. Immediately thereafter distribution of the life raft conforming with the terms of this order may be started and continued.

(ii) The prescribed identification on the life raft does not relieve the aircraft manufacturer or owner of responsibility for the proper application of the life raft in his aircraft, nor waive any of the requirements concerning type certification of the aircraft in accordance with existing Civil Air Regulations.

(iii) If complaints of nonconformance with the requirements of this order are brought to the attention of the Civil Aeronautics Administration, and investigation indicates that such complaints are justified, the Administrator will take appropriate action to restrict the use of the product involved.

(iv) Copies of this Technical Standard Order and other Technical Standard Orders may be obtained from the Civil Aeronautics Administration, Aviation Information Staff, Washington 25, D. C.

[13 F. R. 7734]

§ 4b.811-2 *Technical Standard Order TSO-C13: "Life Preservers" (CAA rules which apply to § 4b.811)*—(a) *Introduction.* (1) Life preservers are in the class of aircraft components which the Administrator of Civil Aeronautics is authorized to approve in accordance with Parts 3, 4a, and 4b of this subchapter.

(2) This Technical Standard Order is intended to service as a criterion by which the product manufacturer can obtain Civil Aeronautics Administration approval of his life preserver.

(3) In the establishment of this Technical Standard Order, consideration has been given to existing Government and industry standards for life preservers for the purpose of adopting the performance requirements of one of the recognized aeronautical standards as the minimum safety requirements for life preservers which are intended for use in civil aircraft. The specification of the National Aircraft Standards Committee for life preservers contains such requirements.

(b) *Directive.*

Provision. Pursuant to §§ 3.31, 3.716, 4a.31, 4a.525, 4a.537, 4b.41, and 4b.811, of the Civil Air Regulations, which authorize the Administrator to approve aircraft equipment, including life preservers, the performance requirements for life preservers as set forth in National Aircraft Standards Specification NAS 801, Airline Life Vests, dated November 19, 1947,[1] stated below, are hereby established as minimum safety requirements for life preservers which are intended for use in civil aircraft:

1. *Applicable specifications.*
1.1 None.
2. *Type and grade.*
2.1 This specification covers minimum performance and safety requirements for all types of airline life vests suitable for commercial transoceanic use.
3. *Materials and workmanship.*
3.1 *Finished fabric.* The finished fabric shall have physical characteristics as follows:
Tensile str. (Grab test)—200×180 #/in. (Min.).
Permeability—10 liters/sq. m./24 hrs. (Max.).
3.2 Life. Rubberized fabrics used shall be reasonably soft for long life storage in folded condition when stored under dark, cool, and dry conditions with temperature variations not to exceed 120° F. max. and minus 10° F. min. for a maximum of 1000 hours and an average of 80° F. for a total life storage of two years.
3.3 *Protection.* All metal parts shall be corrosion resistant or suitably protected against corrosion. All cotton material, ropes and twine shall be mildew proofed.
4. *Detail requirements.*
4.1 *Design and construction.*
4.1.1 *Compartmentation.* The life vest shall have a minimum of two airtight compartments and shall be designed in such a way that any of these compartments when properly inflated will support the wearer in the proper flotation attitude.
4.1.2 *Inflation.* At least two compartments shall be separately inflated by a CO_2 cartridge contained in a suitable puncture type device. Each compartment shall have an oral inflation valve, unless the vest is designed in such a manner that oral inflation in one compartment completely supplements the buoyancy of the other compartments in which event only the oral inflation compartment need have an oral inflation valve. The oral inflation valve must be so placed as to be in an easily accessible position.
4.1.3 *Buoyancy.* The design of the life vest should be such that the buoyancy with CO_2 inflation be a minimum of 20 pounds and the additional buoyancy developed by topping up with air should provide a total buoyancy of the vest of 25 pounds.
4.1.4 *Flotation attitude.* Vest shall support wearer in a reasonably upright position, face up (not more than a 45° angle from vertical). It shall be impossible to stay in a face down position. The vest shall be self-righting.
4.1.5 *Donning vest.* Vest shall be easily donned and comfortably worn. It shall be capable of being donned by the wearer alone. Inflated vest shall be proof against slipping off the wearer but it shall not have straps which pass between the wearer's legs. It shall not chafe the wearer's neck unduly, nor shall it choke him uncomfortably when inflated.
4.1.6 *Fastening or attachment.* The means of attachment of the vest by straps or fasteners shall be conveniently located and easily operated by the wearer. Consideration shall be given to operation of fastening means under conditions of darkness and low temperature.
4.1.7 *Color.* Color shall be high visibility yellow.
4.2 *Marking and instructions.*
4.2.1 *Vest identification.* Each vest shall be legibly and permanently marked with the following information:
a) Manufacturer's Name.
b) Manufacturer's Model and Serial No.
c) National Aircraft Standard No. (NAS 801).
4.2.2 *Placarding instructions.* The vest shall be suitably marked with the words "TOP—FRONT" placed in the proper location to identify the correct wearing position. Instructions shall also be placed on each vest to identify inflation devices and their means of operation.
4.3 *Tests.*
4.3.1 *Pressure test.* Each compartment must withstand without failure a pressure of 10 lbs./sq. in. for 5 minutes when new.
4.3.2 *Leakage test.* No loss of rigidity shall be noted after each compartment of the vest has been inflated to 2 p. s. i. and hung on a rack for 12 hours. Each compartment shall be tested for leakage.

(c) *Application.* (i) Life preservers complying with the specifications appearing in this Technical Standard Order are hereby approved for all aircraft. Life preservers already approved by the Administrator may continue to be installed in aircraft:

(*a*) For which an application for original type certificate is made prior to the effective date of this order,

(*b*) The prototype of which is flown within 1 year after the effective date of this order, and

(*c*) The prototype of which is not flown within 1 year after the effective date of this order if due to causes beyond the applicant's control.

(ii) If a major change is made in the installation within 9 months after the effective date of this order involving a change in type or model of life preservers, previously approved types of life preservers may be installed. However, in any such change made after the 9-month period, new types of life preservers installed in aircraft engaged in overwater operations shall meet the specifications contained herein.

(d) *Specific instructions.*

(1) *Marking.* In addition to the identification information required in the referenced specification, each life preserver shall be permanently marked with the Technical Standard Order designation "CAA-TSO-C13" to identify the life preserver as meeting the requirements of this order in accordance with the manufacturer's statement of conformance outlined below. This identification will be accepted by the Civil Aeronautics Administration as evidence that the established minimum safety requirements for life preservers have been met.

(2) *Data requirements.* None.

(3) *Effective date.* After August 1, 1948, specifications contained in this order will constitute the basis for Civil Aeronautics Administration approval of life preservers for use in certificated aircraft engaged in overwater operations.

(4) *Deviations.* Requests for deviation from, or waiver of, the requirements of this order, which affect the basic airworthiness of the component, should be submitted for approval by the Director, Aircraft Service, Office of Aviation Safety, Civil Aeronautics Administration. These requests should be addressed to the nearest regional office of the Civil Aeronautics Administration, Attn: Superintendent, Aircraft Branch.

(5) *Conformance.* (i) The manufacturer shall furnish to the Civil Aeronautics Administration, Aircraft Service, Attn: A-298, Washington 25, D. C., a written statement of conformance signed by a responsible official of his company, setting forth that the life preserver to be produced by him meets the minimum safety requirements established in this order. Immediately thereafter distribution of the life preserver conforming with the terms of this order may be started and continued.

(ii) The prescribed identification on the life preserver does not relieve the aircraft manufacturer or owner of responsibility for the proper application of the life preserver in his aircraft, nor waive any of the requirements concerning type certification of the aircraft in accordance with existing Civil Air Regulations.

(iii) If the complaints of nonconformance with the requirements of this order are brought to the attention of the Civil Aeronautics Administration, and investigation indicates that such complaints are justified, the Administrator will take appropriate action to restrict the use of the product involved.

(iv) Copies of this Technical Standard Order and other Technical Standard Orders may be obtained from the Civil Aeronautics Administration, Aviation Information Staff, Washington 25, D. C.

[13 F. R. 7736]

§ 4b.812 *Installation of rafts and life preservers.* When such emergency equipment is required, it shall be so installed as to be readily available to the crew and passengers. Rafts released automatically or by the pilot shall be at-

[1] Copies may be obtained from the American Aeronautical Forum, 506 Washington Loan and Trust Building, Washington 4, D. C.

tached to the airplane by means of a line to keep them adjacent to the airplane.

§ 4b.813 *Signaling device.* Signaling devices, when required by Parts 40, 41, and 61 of this subchapter, shall be accessible, shall function satisfactorily, and be free from any hazard in their operation.

§ 4b.814 *First-aid equipment.* The amount of first-aid equipment will vary with the number and distribution of passengers and the type of operation involved and the location(s) of such equipment shall be subject to the approval of the Administrator.

RADIO EQUIPMENT; INSTALLATION

§ 4b.816 *General.* Radio equipment installations in the airplane shall be free from hazards in themselves, in their method of operation, and in their effects on other components of the airplane.

MISCELLANEOUS EQUIPMENT; INSTALLATION

ACCESSORIES

§ 4b.821 *Accessories.* Engine-driven accessories essential to the safe operation of the airplane shall be distributed among two or more engines.

HYDRAULIC SYSTEMS

§ 4b.826 *General.* Hydraulic systems and elements shall be so designed as to withstand, without exceeding the yield point, any structural loads which may be imposed in addition to the hydraulic loads.

§ 4b.827 *Tests.* Hydraulic systems shall be substantiated by proof pressure tests. When proof tested, no part of the hydraulic systems shall fail, malfunction, or experience a permanent set. The proof load of any system shall be 1.5 times the maximum operating pressure of that system.

§ 4b.828 *Lines.* Hydraulic lines and fittings in all designated fire zones (see § 4b.651) shall comply with the provisions of § 4b.654.

[Amdt. 04-1, 11 F. R. 11351]

§ 4b.829 *Reservoirs and accumulators.* Location of hydraulic reservoirs and accumulators shall comply with the provisions of § 4b.652, except when they are an integral part of the engine or propeller.

[Amdt 04-1, 11 F. R. 11351]

OXYGEN SYSTEM

§ 4b.831 *Oxygen system.* When oxygen is provided to comply with the requirements of Parts 41 and 61 of this subchapter, the oxygen system installation shall be free from hazards in itself, in its method of operation, and in its effects on other components of the airplane. The oxygen equipment shall be of a type and design which experience or conclusive tests have shown to be adequate for the use intended. The minimum amount of supplemental oxygen required per person for continuous operation is indicated in Figure 4b–19.

SUBPART G—OPERATING LIMITATIONS

INFORMATION

§ 4b.841 *Information.* Means shall be provided by which the pilot and other appropriate crew members are adequately informed of all operating limitations upon which the type design is based. Any other information concerning the airplane found by the Administrator to be necessary for safety during its operation shall also be made available to the crew.

LIMITATIONS

§ 4b.846 *Limitations.* The operating limitations specified in §§ 4b.849–4b.876 and any similar limitations shall be established for any airplane and made available to the operator as further described in §§ 4b.881–4b.926, unless its design is such that they are unnecessary.

AIR SPEED

§ 4b.849 *Air speed.* The air-speed limitations set forth in §§ 4b.850–4b.854 shall be established.

§ 4b.850 *Never-exceed speed.* (a) This speed shall not exceed the lesser of the following:

(1) 0.9 V_d chosen in accordance with § 4b.189, or

(2) 0.9 times the maximum speed demonstrated in accordance with § 4b.171, but shall not be less than 0.9 times the minimum value of V_d permitted by § 4b.189.

(b) The 0.9 factor may be suitably modified to take into account the increase of drag coefficient at high Mach numbers. The factor used shall be substantiated by flight tests.

§ 4b.851 *Maximum structural cruising speed.* (a) This operating limitation shall be:

(1) Not greater than V_c chosen in accordance with § 4b.189.

(2) Not greater than 0.89 times the never-exceed speed established under § 4b.850.

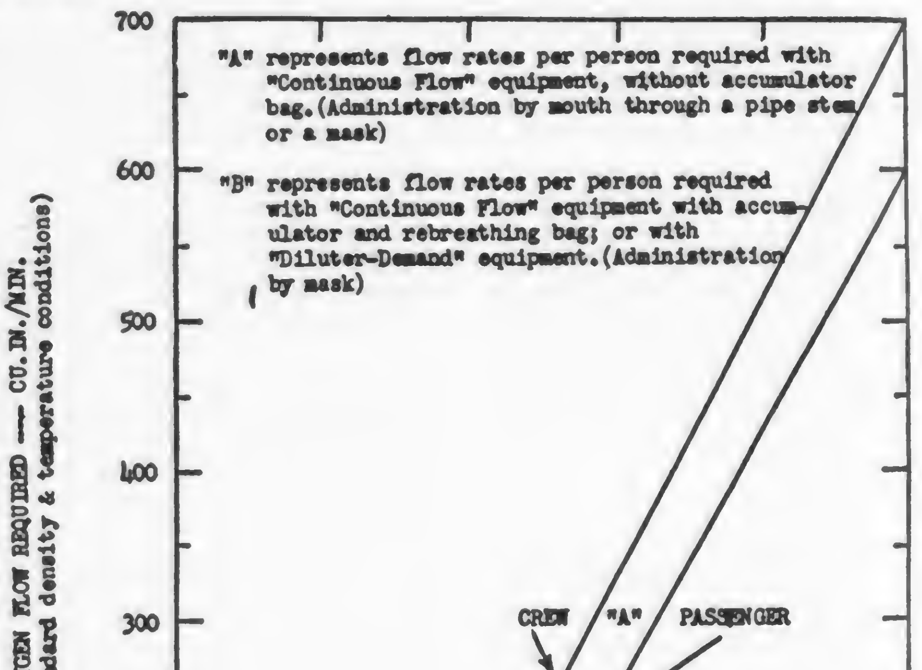
(3) Not less than the minimum V_c permitted in § 4b.189.

(b) The 0.89 factor may be suitably modified to take into account the increase in drag coefficient at high Mach numbers. The factor used shall be substantiated by flight tests.

§ 4b.852 *Maneuvering speed.* See § 4b.189.

§ 4b.853 *Flaps extended speed.* This speed shall not exceed the lesser of the following:

(a) The design flap speed, V_f, chosen in accordance with § 4b.189 or



Altitude—thousands of feet.
(Actual altitude for non-pressurized cabin).
(Equivalent altitude for pressurized cabin).

FIGURE 4b–19.—MINIMUM FLOW OF SUPPLEMENTAL OXYGEN FOR CONTINUOUS OPERATION AT VARIOUS ALTITUDES.

(b) The flap design speed chosen in accordance with § 4b.221, but shall not be less than the minimum value of flap design speed permitted in §§ 4b.189 and 4b.221.

§ 4b.854 *Minimum control speed.* See § 4b.129.

POWER PLANT

§ 4b.861 *General.* The power plant limitations set forth in §§ 4b.862 to 4b.864 shall be established and shall not exceed the corresponding limits established as a part of the type certification of the engine and propeller installed in the airplane.

§ 4b.862 *Take-off operation.* (a) Maximum rotational speed (revolutions per minute).

(b) Maximum permissible manifold pressure.

(c) The time limit upon the use of the corresponding power.

(d) Where the time limit of paragraph (c) of this section exceeds 2 minutes, the maximum allowable cylinder head, or coolant outlet and oil temperatures.

§ 4b.863 *Maximum continuous operation.* (a) Maximum rotational speed (revolutions per minute).

(b) Maximum permissible manifold pressure.

(c) Maximum allowable cylinder head, or coolant outlet and oil temperatures.

§ 4b.864 *Fuel octane rating.* The minimum octane rating of fuel required for satisfactory operation of the power plant at the limits of §§ 4b.862 and 4b.-863.

AIRPLANE WEIGHT

§ 4b.866 *Airplane weight.* The airplane weight and center of gravity limitations are those required to be determined by §§ 4b.81–4b.86.

FLIGHT CREW

§ 4b.871 *Minimum flight crew.* The minimum flight crew shall be established by the Administrator as that number of persons which he finds necessary for safety in the operations authorized under § 4b.876. This finding shall be based upon the work load imposed upon individual crew members with due consideration given to the accessibility and the ease of operation of all necessary controls by the appropriate crew members.

[Amdt. 046-9, 13 F. R. 2158]

TYPES OF OPERATION

§ 4b.876 *Types of operation.* The types of operation to which the airplane is limited shall be established by the category in which it has been found eligible for certification and by the equipment installed. (See Parts 41 and 61 of this chapter.)

MARKINGS AND PLACARDS

§ 4b.881 *Markings and placards.* The markings and placards specified are required for all airplanes. Placards shall be displayed in a conspicuous place and both shall be such that they may not be easily erased, disfigured, or obscured. Additional information, placards, and instrument markings having a direct and important bearing on safe operation may be required when unusual design, operating or handling characteristics so warrant.

INSTRUMENT MARKINGS

§ 4b.886 *General.* The instruments listed in §§ 4b.887–4b.891 shall have the following limitations marked thereon. When these markings are placed on the cover glass of the instrument, adequate provisions shall be made to maintain the correct alignment of the glass cover with the face dial. All arcs and lines shall be of sufficient width and so located as to be clearly and easily visible to the pilot.

§ 4b.887 *Air-speed indicator.* (a) True indicated air speed shall be used:

(1) The never-exceed speed, V_{ne}—a radial red line (see § 4b.850).

(2) The caution range—a yellow arc extending from the red line in subparagraph (1) of this paragraph to the upper limit of the green arc specified in subparagraph (3) of this paragraph.

(3) The normal operating range—a green arc with the lower limit at V_s, as determined in § 4b.93 with maximum take-off weight, landing gear and wing flaps retracted, and the upper limit at the maximum structural cruising speed established in § 4b.851.

(4) The flap operating range—a white arc with the lower limit at V_{s_0} as determined in § 4b.93 at the maximum landing weight, and the upper limit at the flaps extended speed in § 4b.853.

(b) When the never-exceed speed and maximum structural cruising speed vary with altitude, means shall be provided which will indicate the appropriate limitation to the pilot throughout the operating altitude range.

§ 4b.888 *Magnetic direction indicator.* A placard shall be installed on or in close proximity to the magnetic direction indicator which contains the calibration of the instrument in a level flight attitude with engine(s) operating and radio receiver(s) on or off (which shall be stated). The calibration readings shall be those to known magnetic headings in not less than 45° increments.

§ 4b.889 *Power-plant instruments.* All required power-plant instruments shall be marked with a red radial line at the maximum, and minimum (if applicable) indications for safe operation. The normal operating ranges shall be marked with a green arc which shall not extend beyond the maximum and minimum limits for continuous operation. Take-off and precautionary ranges shall be marked with a yellow arc.

§ 4b.890 *Oil quantity indicators.* Indicators shall be suitably marked in sufficient increments so that they will readily and accurately indicate the quantity of oil.

§ 4b.891 *Fuel quantity indicator.* When the unusable fuel supply for any tank exceeds 1 gallon or 5% of the tank capacity, whichever is greater, a red band shall be placed on the indicator which extends from the calibrated zero reading to the lowest reading obtainable in the level flight attitude, and a suitable notation in the airplane operating manual shall be provided to indicate to the flight personnel that the fuel remaining in the tank when the quantity indicator reaches zero cannot be used safely in flight. (See § 4b.713.)

CONTROL MARKINGS

§ 4b.896 *General.* All cockpit controls, with the exception of the primary flight controls, shall be plainly marked and/or identified as to their function and method of operation.

§ 4b.897 *Aerodynamic controls.* The secondary controls shall be suitably marked to comply with §§ 4b.353 and 4b.354.

§ 4b.898 *Power-plant fuel controls.* (a) Controls for fuel tank selector valves shall be marked to indicate the position corresponding to each tank and any cross-feed positions that may exist.

(b) When more than one fuel tank is provided, and if safe operation depends upon the use of tanks in a specific sequence, the fuel tank selector controls shall be marked adjacent to or on the control to indicate to the flight personnel the order in which the tanks should be used.

(c) Controls for engine selector valves shall be marked to indicate the position corresponding to each engine.

§ 4b.899 *Accessory and auxiliary controls.* (a) When a retractable landing gear is used, the visual indicator required in § 4b.384 shall be marked in such a manner that the pilot, at all times, can ascertain when the wheels are secured in either extreme position.

(b) Emergency controls shall be colored red and clearly marked as to their method of operation.

MISCELLANEOUS MARKINGS AND PLACARDS

§ 4b.901 *Baggage compartments and ballast location.* Each baggage or cargo compartment and ballast location shall bear a placard which states the maximum allowable weight of contents and, if applicable, any special limitation of contents due to loading requirements, etc.

§ 4b.902 *Fuel, oil, and coolant filler openings.* The following information shall be marked on or adjacent to the filler cover in each case:

(a) The word "fuel", the minimum permissible fuel octane number for the engines installed, and the usable fuel tank capacity. (See § 4b.494.)

(b) The word "oil" and the oil tank capacity.

(c) The name of the proper coolant fluid and the capacity of the coolant system.

§ 4b.903 *Emergency exit placards.* Emergency exits shall be clearly marked as such in letters not less than ¾ inch high with luminous paint, such markings to be located either on or immediately adjacent to the pertinent exit and readily visible to passengers. Location and method of operation of the handles shall be marked with luminous paint. (See § 4b.434.)

§ 4b.904 *Operating limitation placard.* A placard shall be provided in front of and in clear view of the pilot(s) stating: "This airplane must be operated in compliance with the operating limitations specified in CAA approved airplane operating manual."

AIRPLANE OPERATING MANUAL

§ 4b.911 *Airplane operating manual.* An airplane operating manual shall be furnished with each airplane. (See Parts 41 and 61 of this subchapter.) The portions of the manual listed in §§ 4b.912–4b.926 shall be verified and approved by the Administrator. Additional items of information having a direct and important bearing on safe operation may be required when unusual design, operating or handling characteristics so warrant. The manual shall contain, as a minimum, the provisions of §§ 4b.916–4b.926.

§ 4b.911–1 *Airplane Flight Manual (CAA policies which apply to § 4b.911).* (a) *Purpose.* The purpose of this statement of policy is to outline an acceptable arrangement for the Airplane Flight Manual[1] as required by § 4b.911 effective November 9, 1945. Although this material is intended to apply to Part 4b of this subchapter, it may also be used as a guide for the manual required by 4a.760–T. This policy does not affect the status of manuals which already have final or tentative approval. However, whenever such manuals are revised for other reasons, it is recommended that the terminology of this policy be incorporated wherever it will increase clarity and uniformity. It should be noted that not all the items outlined below for inclusion in the document will be necessary for a given airplane, and the Civil Aeronautics Administration is desirous of holding the document to the smallest practicable amount of material. Only the material (listed below) required by 4b should be included in the Civil Aeronautics Administration approved portion of the manual. However, if desired, the manufacturer or operator may add other data in a distinctly separate section in the same cover. The portion of the material (outlined below) that is to be approved by the Civil Aeronautics Administration must be so marked, and clearly separated from any other material so that no one could easily err in regard to the part that is approved.

(b) *Form.* The page size for the Airplane Flight Manual will be left to the decision of the manufacturer. A cover should be provided and it should indicate the nature of the contents with the following title: "Airplane Flight Manual." Each page of the approved portion should bear the notation "CAA Approved" and the date of issuance. The material should be bound in a semipermanent fashion so that the pages will not be lost easily, yet should be so bound that revised pages can be inserted. The aircraft specification will identify the manual, and when different types of the airplane (skiplanes, seaplanes, etc.) are covered in separate manuals, each will be listed. Also, the latest approved revisions will be shown on the specification when these changes are considered of major importance to airworthiness.

(c) *Content.* The Airplane Flight Manual should contain as much of the following as is applicable to the individual model. It is suggested that the document be divided into sections as indicated. The sequence of sections and of items within sections should follow the outline below insofar as practicable. This will facilitate revising the document when an airplane is altered in the field.

(a) *Introduction*—(1) *Title page.* This page should include the manufacturer's name, airplane model, registration or serial number, date of approval and space for the signature of the Director, Aircraft Service. In addition the following note should be included: "This airplane must be operated in compliance with the Operating Limitations contained herein."

(2) *Table of contents.*

(3) *Log of revisions.* Should provide spaces in which to record revised pages and the date inserted.

(b) *Operating limitations*—(1) *Weight limits.* In addition to the maximum weights and any relative information, a statement to the effect that the airplane must be loaded in accordance with the approved loading schedule should be included. (See paragraph (e), Weight and Balance Data.) The following is a typical example:

(i) Maximum take-off weight at sea level is 92,000 pounds.

(ii) Maximum landing weight at sea level is 73,000 pounds.

NOTE: This airplane is to be operated in accordance with the approved loading schedule (paragraph (e)).

For maximum permissible weights at various altitudes, see paragraph (d), Performance Information. In scheduled passenger operations, operating weights are limited in accordance with Parts 41 or 61 of this subchapter.

(iii) All weight in excess of the maximum permissible landing weight must consist of disposable fuel.

(iv) All weight in excess of 68,000 pounds must consist of fuel for structural reasons.

(v) All fuel weight must be distributed equally on both sides of the airplane. All main tanks must be filled (equally) first, alternates second, and then auxiliaries. Fuel must be used in reverse order from fuel loading except for take-off, climb and landing, at which time the main tanks should be used.

(2) *Center of gravity limits.* All center of gravity limits should be given in inches from the datum, which should be identified, and in percent of the mean aerodynamic chord, with the landing gear extended.

(3) *Power plant.* The following should be listed:

(i) Engine:

(*a*) Manufacturer.

(*b*) Model.

(*c*) Propeller drive gear ratio.

(*d*) Fuel, minimum octane.

(*e*) Temperatures—maximum permissible cylinder head and oil inlet.

(*f*) Power limits—those given by the engine specification; i. e., excluding the effect of ram on critical altitude.

(*g*) Any limitations, such as r. p. m. ranges in which operation is prohibited due to engine or propeller vibration.

(ii) An explanation of the instrument markings should be included. A typical example follows:

(*a*) General: Red radial line—maximum and minimum limits. Yellow arc—take-off and precautionary ranges. Green arc—normal operating ranges. Red arc—ranges in which operation is prohibited.

(*b*) Fuel quantity indicator (when applicable—reference § 4b.891 of this subchapter). Red arc—fuel which cannot be used safely in flight.

(iii) Propellers:

(*a*) Manufacturer.

(*b*) Model designation.

(4) *Speed limitations.* (i) Current Regulations (§ 4b.887 of this subchapter) require that air-speed indicator markings be in terms of "true indicated" (calibrated) air speed. However, the "indicated" air speed may also be included parenthetically in addition to the "calibrated" air speed if desired. This offers the advantage that the pilot may read the correct limitation directly from the instrument.

(ii) The following speeds and explanations of their significance should be included:

(*a*) Never-exceed speed, V_{ne} (previously known as "glide or dive speed") with and without de-icer boots, if applicable, plus a statement to the effect that speeds in excess of this value may result in structural, flutter, or control hazards. The effects of altitude (i. e. Mach number) on this speed should be given if applicable unless the airplane is equipped with a Machmeter, in which case the "never-exceed" Mach number should also be quoted.

(*b*) Normal operating limit speed, V_{no}, (previously known as "level flight or climb speed" or "maximum structural cruising speed"), with and without de-icer boots if applicable, plus statements to the effect that:

(*1*) Speeds in excess of this value may result in excessive gust loads, whereas speeds below this value will reduce the structural loads produced by severe gusts. The "maneuvering speed" is generally considered the optimum speed to avoid excessive loads as well as inadvertent stalling or loss of control in turbulent air.

(*2*) This speed should not be deliberately exceeded, even during descents, because of the possibility of unexpected gusts.

(*3*) The speed range between V_{no} and V_{ne} is to provide for inadvertent speed increases.

(*4*) When this speed is reduced at altitude because of Mach number effects, the purpose of such reduction is to maintain the margin between V_{no} and V_{ne} for inadvertent speed increases.

(*c*) Maneuvering speed, V_p, plus a statement of its significance, of which the following is an example: "Maximum use" of the primary flight controls should be confined to speeds below this value. For this purpose, "maximum use" is defined as the lesser of the following:

Rudder—full throw, or ---- pounds force.
Elevator—full throw, or ---- pounds force.
Aileron—full throw or ---- pounds force with each hand.

(*d*) Flaps extended speed, V_{fe} at least the speed determined in accordance with § 4b 853 of this subchapter must be given. However when desired, speeds for various combinations of flap settings and power conditions may be given. The following is an example:

Flap setting	*Max. speed (m. p. h.)*	*Max. power*
Take-off	------------------	Take-off.
Approach	------------------	Continuous.
	------------------	Take-off.
Landing	------------------	Throttled.
	------------------	Take-off.

(A note should be added to indicate which of the values is to be marked on the air-speed indicator.)

(*e*) Landing gear operating speed, V_{lo}, plus a statement that this is the maximum speed at which the landing gear may be lowered or raised.

[1] The term "Airplane Flight Manual" has been agreed upon internationally to distinguish the airplane manual from the "operations manuals" issued by air lines and covering the general field of operating practices. Recommendations have been made to the CAB to revise the title of § 4b.911 and the air-speed limitation terminology in accordance with this policy.

(*f*) Landing gear extended speed, V_{le}, plus a statement that this is the maximum speed with landing gear extended and locked.

(iii) When a speed limitation (e. g., never exceed speed) results from compressibility effects, the manual should include a statement to this effect and information concerning warning symptoms, probable behavior of the airplane and suggested recovery procedure.

(iv) An explanation of the air-speed indicator markings should be included. A typical example follows:

Air-speed indicator markings

(See definitions of speeds above)

Red radial line—never-exceed speed, V_{ne}.
Yellow arc—caution range, extending from V_{no} to V_{ne}.
White arc—flaps extended range, extending from stalling speed (V_{s_0}) with flaps in landing position at maximum landing weight to the flaps-extended speed (§ 4b.853 of this subchapter).
Green arc—normal operating range: i. e., from stalling speed with flaps retracted at maximum take-off weight to V_{no}.

(5) *Critical cross wind.* Plus a statement that this is the maximum cross component of wind velocity at which it has been demonstrated to be safe to take-off or land. If the value established during the tests is considered the maximum up to which it is considered safe to operate the airplane on the ground, including take-offs and landings, it should be entered under this item; i. e., as a limitation. However, if the value established is not considered limiting it should be included as Performance Information (paragraph (d)) instead of a limitation. In the case of flying boat an additional maximum cross component of wind velocity for taxiing may be appropriate material.

(6) *Flight load acceleration limits.*

Flaps up_______________ (At take-off weight).
Flaps down_____________ (At landing weight).

(7) *Type of airplane operation.* A typical example would be as follows:

(i) Transport category.

(ii) Instrument night flying (when required equipment is installed).

(iii) Atmospheric icing conditions—should stipulate "none, trace, light, moderate or heavy".

(iv) Propeller reversing to be used for taxiing only.

(8) *Minimum crew.* Should be given for day contact flight and any additional conditions if desired or considered pertinent.

(9) *Miscellaneous.* Should include any information not given above that is restrictive and considered necessary for the safe operation of the airplane. Some typical examples are as follows:

(i) The wing and tail anti-icing heaters should not be operated in flight when the outside air is above 50° F.

(ii) Pressurized cabin differential pressure limits, etc.

If any of the above limitations are repeated necessarily in some other section of the manual; e. g., Operating Procedures (paragraph (c)), it is considered desirable that the limitation be referenced to the pertinent portion of the manual where it is repeated.

(c) *Operating procedures*—(1) *Normal.* This section should contain information and instructions regarding peculiarities of: Starting and warming engines, taxying, operation of wing flaps, landing gear, etc. Also included in this section should be instructions for the operation of any equipment that is considered new in the aeronautical field or comparatively complicated.

(i) A typical example of the former would be: Wing flaps should be exercised through three complete cycles prior to all initial take-offs. This operation accomplishes the automatic bleeding and the equalization of pressure to the eight separate hydraulic flap actuating cylinders.

(ii) Typical examples of the latter are:

(*a*) Recommended operating procedures for thermal ice prevention system.

(*b*) Recommended operating procedures for reversible pitch propellers.

(*c*) Cabin pressurization.

(2) *Emergency procedures.* The following should be included:

(i) The procedure to be used in the event of an engine failure, including recommended minimum speeds, trim, operation of remaining engine(s), etc. A typical example would be as follows:

Engine failure on take-off. The minimum speed (V_1) at which the airplane can be controlled directionally on the runway with an outboard engine inoperative and its propeller windmilling, and with take-off power on the remaining engines, is 60 miles per hour TIAS.

The minimum speed at which the airplane is controllable in flight with the sudden failure of an outboard engine, with take-off power on the remaining engines, is 96 miles per hour TIAS.

If an engine fails during the ground roll below speed V_1, cut the throttles on all engines and apply brakes. If ground contact has already been broken, land straight ahead if sufficient runway remains. If not, retract landing gear, maintain full power on live engines, and continue take-off. Feather the dead engine as outlined in item (ii) below. Use minimum cowl flap setting on live engines to maintain cylinder temperature within limits. Retrim airplane as necessary. Speed for best climb under these conditions is 115 miles per hour TIAS.

See paragraph (d) (pages 9 and 12) for criterion and V_1 speeds used in determining the runway lengths.

(ii) Propeller feathering. This section of the manual should outline the procedure to be followed in stopping the rotation of propellers in flight.

A typical procedure is outlined below:

(*a*) Throttle—"Closed."

(*b*) Push feathering switch button. When propeller blades are fully feathered the button will kick out automatically.

(*c*) Mixture control—"Idle cut-off."

(*d*) Cowl flaps—"Closed."

(*e*) Fuel booster pump—"Off."

(*f*) Tank selector for engine being feathered—"Off." (Do not shut tank selector "Off" if cross feed is being used.)

(*g*) Ignition for dead engine—"Off."

(*h*) Propeller pitch control—"Full decrease revolutions per minute."

(iii) Any emergency procedures that are considered unusual or in which a specific sequence of events are required to accomplish the operation satisfactorily. Some typical examples are as follows:

(*a*) All-engine go-around when it is recommending practice to retract the flap prior to retracting the gear resulting from a design condition in which the flap creates more drag than the gear.

(*b*) Fire control procedures.

(*c*) Emergency cabin depressurization.

(*d*) Emergency landing gear extension.

(*e*) Emergency brake operation.

(*f*) Fuel dumping.

(*g*) Electrical—including operation of circuit breakers. The manual should specify the circuits in which overriding breakers, if any, are used and contain instructions concerning operation of both overriding and nonoverriding types. The following is a typical example:

All circuit breakers are of the nonoverriding type except the fuel booster pumps and propeller feathering circuits. In an emergency, the breakers in these two circuits may be held closed with the possible risk of fire hazard due to short circuits, etc. Discretion should also be used in repeatedly resetting nonoverriding breakers due to the fact that resetting may reestablish an arc and increase the fire hazard.

(3) *Other special operating procedures (if any).*

(d) *Performance information*—(1) *Introductory information.* This should include any general information or any pertinent descriptions of the conditions under which the performance data were determined. The following examples are considered typical and appropriate:

(i) All climb data are for standard atmospheric conditions.

(ii) The minimum effective take-off runway lengths given in this section are defined as the longer of the "accelerate-stop distance" and the distance required to take-off and clear a 50-foot obstacle with one engine becoming inoperative at speed V_1.

(*a*) The accelerate-stop distance is the distance required to accelerate the airplane from a standing start to the speed, V_1, and assuming an engine to fail at this point, to stop.

(*b*) The take-off distance is defined as the sum of the following:

(*1*) Distance to accelerate to speed V_1 with all engines operating.

(*2*) Distance to accelerate from speed V_1 to speed V_2 with one engine in operative and propeller windmilling in low pitch. It is assumed that gear retraction is initiated at the end of this segment.

(*3*) The horizontal distance traveled in climbing to a height of 50 feet at speed V_2 with one engine inoperative. It is assumed that propeller feathering is not commenced prior to the end of this segment.

(*i*) Speed V_1 is defined as the critical engine failure speed and is a speed at which the controllability has been demonstrated to be adequate to permit proceeding safely with the take-off when the critical engine is suddenly made inoperative. The minimum V_1 speed for this airplane is 60 miles per hour TIAS; however, as explained below, speeds in excess of this value were used in determining the runway lengths.

(*ii*) Speed V_2 is defined as the minimum take-off climb speed and is the greater of the following: 1.15 times the power-off stalling speed with the flaps in the take-off position (assuming a four-engine airplane); 1.10 times the minimum control speed, V_{mc}.

The minimum control speed, V_{mc}, is defined as the minimum speed at which the airplane is controllable in flight with the sudden failure of an outboard engine with take-off power on the remaining engines.

(*c*) All runway lengths given in this manual are based upon optimum V_1 speeds; i. e., the speed selected for V_1 is such that the accelerate and stop distance is equal to the distance to clear a 50-foot obstacle with one engine becoming inoperative at this speed. Consequently, V_1 varies with weight, altitude, wind, gradient, etc. Values for V_1 for the various conditions are given on page 11.

(*d*) All take-off and landing distances given are for dry, concrete runways.

(*e*) If the maximum cross component of wind velocity in which landings and take-offs were demonstrated was not considered limiting, it should be included in this section of the manual. A typical example would be as follows:

The maximum crosswind component in which this airplane has been tested is 20 miles per hour measured at a height of 50 feet above the ground. Consequently, in determining the effective take-off and landing runway lengths, a crosswind component greater than this value may not be used.

(2) *Performance data.* These data may be given in either graphical or tabular form and should cover the weight range and all airport and terrain altitudes at which the airplane is intended to be operated. The scale of the charts should permit accurate reading within approximately 0.25 of 1 percent.

Following is a list of data that should be included:

(i) Air speed calibration—normal and alternate static source.

(ii) Altimeter calibration—normal and alternate static source.

(iii) True indicated stalling speeds at all appropriate flap positions.

(vi) Summary of permissible operating, landing and take-off gross weights as limited by the climb of structural requirements.

(v) Minimum take-off runway length. Unless optimum values of V_1 are selected, establishing equal distances to accelerate to speed V_1 and stop or to make a take-off over a 50-foot obstacle with the critical engine becoming inoperative at speed V_1 inclusion of both the accelerate and stop distance and runway length required to take-off and clear a 50-foot obstacle will be necessary. It is recommended that these data be given a range of temperatures and runway gradients sufficient to permit proper dispatching under the rules of § 61.213 of this subchapter in addition to the required standard day temperature data.

(vi) Take-off flight paths through the final climb segment, flight path slope or data slope or data supplementary to the above subdivision (v) that may be used for dispatching purposes should be included. These should be for the same range of temperatures and runway gradients as subdivision (v).

[1] (vii) Minimum take-off climb speed, V_2, for the range of weights, altitudes and conditions covered in subdivisions (v) and (vi).

[1] (viii) Critical-engine-failure speed, V_1 or speeds V_1 for the range of weights, altitudes and conditions covered in subdivision (v) and (vi) (if applicable).

(ix) Minimum runway length required for landing. With respect to this item, the following data would be considered appropriate:

(*a*) Landing distance from height of 50 feet.

(*b*) Minimum effective landing runway length—scheduled stops.

(*c*) Minimum effective landing runway length—alternate stops.

(x) If it is desired to take advantage of wind in determining landing and take-off distances all data should be based upon wind velocities reported at a height of 50 feet above the runway; i. e., the runway length would be calculated for one-half of the reported head wind velocity, or twice the reported tail wind velocity, measured at a height of 50 feet corrected to the height of the center of aerodynamic drag of the airplane. A note clearly stating the above stipulations should be included in the manual.

(xi) The rates of climb and climbing speeds for the desired range of weights and altitudes, together with the corresponding airplane configuration (flap position, gear position, etc.), should be given for the following when applicable:

(*a*) First segment take-off climb (§ 4b.103 (a)).

(*b*) Second segment take-off climb (§ 4b.103 (a)).

(*c*) Third segment take-off climb (§ 4b.97 (d)).

(*d*) Final segment take-off climb (§ 4b.97 (e)).

(*e*) One-engine-inoperative en route climb (§ 4b.103 (b)).

(*f*) All-engine en route climb (§ 4b.102 (a)).

(*g*) Two-engines-inoperative en route climb (§ 4b.104).

(*h*) Approach climb (§ 4b.103 (c)).

(*i*) Landing climb (§ 4b.102 (b)).

(xii) Engine power curve.

[1] The distance to accelerate to these speeds should also be included to provide data necessary for gradient problems involving runways with variable gradients of sufficient magnitude that average gradients cannot be assumed.

(xiii) Any instructions or examples for use of the performance charts.

(e) *Weight and balance data.* (1) Inasmuch as it is desired to eliminate the necessity of submitting revisions of the Airplane Flight Manual to the CAA for approval whenever an item of equipment is altered or added, this section of the manual will not be included in the formally approved portion of the document. However, a note to the effect that the airplane should be operated in accordance with the approved loading schedule should be included in the Limitations Section. (See paragraph (b) (1)—Weight Limits.)

(2) It is the intention of the Civil Aeronautics Administration to place the responsibility for the control of weight and balance with the manufacturer and operator. The manufacturer will furnish a weight and balance report for each new airplane which may be included in the manual but not in the approved portion. The Civil Aeronautics Administration's representative will not approve each individual report but will make only occasional spot checks to ascertain that the manufacturer's weight control procedure is adequate. The manufacturer will be expected to furnish complete information with the airplane, not only regarding its actual weight and balance, but also to include sketches, samples and other data that will assist the operator in checking the balance after alterations.

(3) The following material is believed to be complete and adequate for a conventional airplane.

(i) Weight limits. Should list and explain (where necessary) the various weight limits.

(ii) Center of gravity limits. Approved operating center of gravity range.

(iii) Empty weight and empty weight center of gravity location.

(iv) Equipment list. All equipment included in the empty weight.

(v) Weight computations. The computations necessary to determine the empty weight center of gravity location, including identification of balance datum.

(vi) Loading schedule.

(vii) Loading schedule instructions. Complete instructions in the use of the loading schedule.

In the case of unconventional airplane or airplanes with special features, the foregoing should be modified or amplified as necessary to cover the case.

(d) *Submittal.* Three copies of the above material, less the Weight and Balance Data Section, should be submitted to the appropriate Civil Aeronautics Administration regional office by the applicant for an original approval. The three copies will be signed by the Director, Aircraft Service; one copy will be returned to the applicant, one will be retained by the Washington office and the other by the regional office. A single copy of the title page to be used for the Director's signature may be substituted for the manufacturer's copy if desired. Revisions to the manual will be approved in the regional office. In cases where the revisions are of primary importance to safety in flight, the pertinent Aircraft Specification will contain a description of the change to insure that all manuals are revised. A revision of this type would probably be the subject of an Airworthiness Directive note. One copy of the Weight and Balance Data Section should be included in the manual by the manufacturer for each airplane at the time of certification.

[13 F. R. 4182. Correction noted at 14 F. R. 37]

OPERATING LIMITATIONS AND PROCEDURES

§ 4b.916 *Operating limitations.* This part of the manual shall contain the operating limitation information listed below:

(a) *Air-speed limitation.* Sufficient information shall be included in this section of the manual to permit proper marking of the air-speed limitations on the indicator as required in § 4b.887. It shall also include the design maneuvering speed and the maximum safe air speed at which the landing gear can be safely lowered. In addition to the above information, the manual shall explain the significance of the air-speed limitations, and the color coding used. The explanation of the maneuvering speed shall include a statement to the effect that maneuvers involving an approach to a stall, or full application of rudder or aileron controls, should be confined to speeds below this value.

(b) *Power plant limitations.* Sufficient information shall be included in this section of the manual to outline and explain all power-plant limitations (see §§ 4b.861–4b.864) and to permit marking the instruments as required in § 4b.889.

(c) *Weight and loading distribution.* The airplane weights and center of gravity limits required to be determined by §§ 4b.81–4b.86, together with the items of equipment on which the weight empty is based, shall be entered in this section of the manual. Where the variety of possible loadings warrants, instructions adequate to insure observance of those limitations shall be included in this section of the manual. (See also § 4b.82 (b).)

(d) *Flight load acceleration limits.* The positive limit load factors made good by the airplane structure shall be described here in the manual in terms of accelerations.

(e) *Flight crew.* The number and functions of the minimum flight crew required to operate the airplane safely, which has been determined by the requirements of § 4b.871, shall be entered in this section of the manual.

(f) *Type of airplane operation.* This section of the manual shall state the type(s) of operation(s) for which the airplane and its necessary equipment installations have been certificated.

[Amdt. 04–0, 11 F. R. 71, as amended by Amdt. 04b–5, 12 F. R. 3933]

§ 4b.921 *Operating procedures.* This part of the manual shall contain information indicated in paragraphs (a), (b), and (c) of this section which is peculiar to the airplane, and which concerns the normal and emergency procedures necessary to their safe performance by the crew.

(a) *Normal.* This section shall contain information and instructions regarding peculiarities of: Starting and warming engines, taxying, operation of wing flaps, landing gear, automatic pilot, etc.

(b) *One-engine-inoperative.* This section of the manual shall outline the procedure to be used in the event of engine failure, including recommended minimum speeds, trim, operation of remaining engine(s), etc.

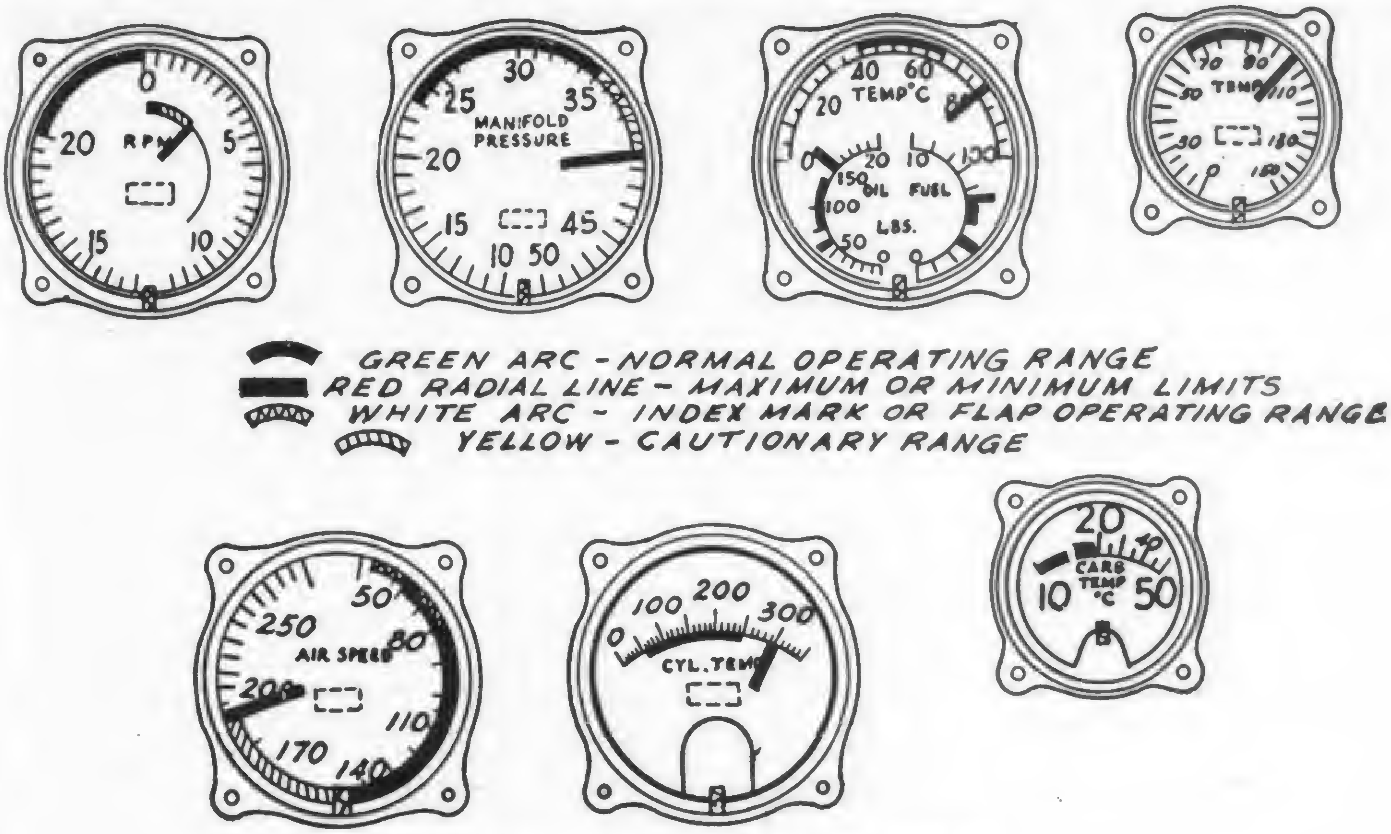


FIGURE 4b-20.—REPRESENTATIVE INSTRUMENT MARKINGS.

(c) *Propeller feathering.* The desirable procedure to be followed in stopping the rotation of propellers in flight shall be included in this section of the manual.

PERFORMANCE

§ 4b.926 *Performance information.* This part of the manual shall contain the performance information listed below:

(a) *Performance data.* A summary of all performance data secured in accordance with §§ 4b.91–4b.114 Performance requirements, as well as all data derived therefrom, required for the application of the operating rules of §§ 61.213–61.222 of this subchapter. Also, any pertinent descriptions of the conditions, air speeds, etc., under which the above data were determined.

(b) *Flap controls.* Adequate instructions for the use and adjustment of the flap controls necessary to obtain the desired performance.

(c) *Air speeds.* The indicated air speeds corresponding to those determined in §§ 4b.94–4b.97 Take-off, together with pertinent discussion of procedures to be followed if the critical engine becomes inoperative during take-off.

(d) *Miscellaneous.* Include a discussion of any significant or unusual flying or ground handling characteristics, knowledge of which would be useful to a pilot who has not previously flown the airplane and which would thereby enable him more readily to obtain maximum performance.

SUBPART H—AIRPLANE IDENTIFICATION DATA

§ 4b.931 *Name plate.* A name plate shall be securely attached and shall contain:

(a) The manufacturer's name and address,
(b) Model and serial numbers,
(c) Date of manufacture,
(d) Type certification number.

§ 4b.932 *Airworthiness certificate number.* The identifying symbols and registration numbers shall be permanently affixed to the airplane structure in compliance with § 43.10 (c) and (d) of this subchapter.

PART 6—ROTORCRAFT AIRWORTHINESS

GENERAL

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AUTHORITY: §§ 6.1 to 6.61 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply sec. 601, 52 Stat. 1007; 49 U. S. C. 551.

SOURCE: §§ 6.1 to 6.61 contained in Amendment 06-0, Civil Air Regulations, 11 F. R. 6963, except as noted following sections affected. Redesignated by SR-327, 13 F. R. 5486.

GENERAL

§ 6.1 *Scope.* In order to become eligible for type and airworthiness certificates, a rotorcraft shall be shown to comply with the airworthiness requirements set forth in this part and shall have no characteristic which, according to the findings of the Administrator, renders the rotorcraft unairworthy: *Provided*, That:

(a) If any of the requirements in this part become inapplicable to a particular rotorcraft because of increased knowledge of aeronautics or of the development of unforeseen design features, the Administrator shall accept designs shown to provide an equivalent standard of safety.

(b) Requirements of the U. S. Army or Navy, with respect to airworthiness found by the Administrator to provide an equivalent standard of safety, may be accepted in lieu of the requirements set forth in this part.

Unless otherwise specified, compliance with any amendment to this part shall be mandatory only for rotorcraft for which application for a type certificate has been received subsequent to the effective date of such amendment.

§ 6.2 *Type certificate.* A type certificate will be issued when the following requirements are met:

(a) *Data required for NC (standard) and NR (restricted) certification.* The applicant for a type certificate shall submit to the Administrator the following: Such descriptive data, test reports, and computations as are necessary to demonstrate that the rotorcraft complies with the airworthiness requirements. The descriptive data shall be known as the type design and shall consist of drawings and specifications disclosing the configuration of the rotorcraft and all design features covered in the airworthiness requirements as well as sufficient information on dimensions, materials, and processes to define the strength of the structure. The type design shall describe the rotorcraft in sufficient detail to permit the airworthiness of subsequent rotorcraft of the same type to be determined by comparison with the type design.

(b) *Inspection and tests for NC and NR certification.* The authorized representatives of the Administrator shall have access to the rotorcraft and may witness or conduct such inspections and tests as are necessary to determine compliance with the airworthiness requirements.

(1) *Inspection.* Inspections and tests shall include all those found necessary by the Administrator to insure that the airplane conforms with the following:

(i) All materials and products are in accordance with the specification given in the type design.

(ii) All parts of the rotorcraft are constructed in accordance with the drawings contained in the type design.

(iii) All manufacturing processes, construction, and assembly are such that the design, strength, and safety contemplated by the type design will be realized in service.

(2) *Flight tests.* Upon satisfactory completion of all necessary inspection and testing on the ground, and upon receipt from the applicant of a report of flight tests conducted by him, and satisfactory proof of the conformity of the rotorcraft with the type design, such official flight tests as the Administrator finds necessary to prove compliance with this part shall be conducted.

[Amdt. 06-0, 11 F. R. 6963, 7565, as amended by Amdt. 06-2, 13 F. R. 2966]

§ 6.3 *Airworthiness certificates.* Airworthiness certificates are classified as follows:

(a) *NC certificates.* In order to become eligible for an NC certificate the rotorcraft shall be shown to comply with all of the requirements contained in this part.

(b) *NR certificates.* NR certification is applicable to rotorcraft intended to be operated for restricted purposes not logically encompassed by the requirements of this part. In order to be eligible for an NR certificate, a rotorcraft must be shown to comply with all of the requirements of this part which are not rendered inapplicable by the nature of the special purpose involved, and shall be subject to suitable operating restrictions which the Administrator finds will provide a level of safety equivalent to that contemplated for normal purposes by the requirements of this part.

(c) *NX (experimental) certificates.* A rotorcraft will become eligible for an NX certificate when the applicant presents satisfactory evidence that the rotorcraft is to be flown for experimental purposes and the Administrator finds that it may, with appropriate restrictions, be operated for that purpose in a manner which does not endanger the general public. Rotorcraft used in racing and exhibition flying may be issued NX certificates under the terms of this section. The applicant shall submit sufficient data such as photographs to identify the rotorcraft satisfactorily and upon inspection of the rotorcraft, any pertinent information found necessary by the Administrator to safeguard the general public.

A rotorcraft manufactured in accordance with a type certificate (see § 6.2) and conforming with the type design will become eligible for an NC airworthiness certificate when, upon inspection of the rotorcraft, the Administrator finds it so to conform and in a condition for safe operation. For each newly manufactured rotorcraft this finding shall include a flight check by the applicant.

For rotorcraft manufactured by holders of a production certificate the issuance of an NC airworthiness certificate shall be dependent upon the provisions of Part 2 of this subchapter.

[Amdt. 06-0, 11 F. R. 6963, as amended by Amdt. 06-2, 13 F. R. 2966]

§ 6.4 *Changes.* Changes shall be substantiated to demonstrate compliance of the rotorcraft with the appropriate airworthiness requirements in effect when the particular rotorcraft was certificated as a type unless the applicant chooses to show compliance with the currently effective requirements subject to the approval of the Administrator, or unless the Administrator finds it necessary to require compliance with current airworthiness requirements.

(a) *Minor changes.* Minor changes to certificated rotorcraft which obviously do not impair the condition of the airplane for safe operation shall be approved by the authorized representatives of the Administrator prior to the submittal to the Administrator of any required revised drawings.

(b) *Major changes.* A major change is any change not covered by minor changes as defined in paragraph (a) of this section.

(c) *Service experience changes.* When the Administrator finds that service experience indicates the need for design changes, the applicant shall submit for the approval of the Administrator engineering data describing and substantiating the necessary changes. The Administrator may in such cases withhold issuance of airworthiness certificates for additional rotorcraft of the type involved until satisfactory corrective measures have been taken. Upon approval by the Administrator, these changes shall be considered as a part of the type design, and descriptive data covering these changes shall be furnished by the applicant to all rotorcraft owners concerned.

(1) In the case of rotorcraft approved as a type under the terms of earlier airworthiness requirements, the Administrator may require that a rotorcraft submitted for an original airworthiness certificate comply with such portions of the currently effective airworthiness requirements as may be necessary for safety.

§ 6.5 *Definitions.* The following definitions apply to the terms as used in this part:

(a) *Rotorcraft.* Any aircraft deriving its principal lift from one or more rotors.

(b) *Helicopter.* A rotorcraft which depends entirely for its support and motion in the air upon the lift generated by one or more power-driven rotors.

(c) *Gyroplane.* A rotorcraft which depends principally for its support upon the lift generated by one or more rotors which are not power driven, except for initial starting, and which are caused to rotate by the action of the air when the rotorcraft is in motion.

(d) *Main rotor(s).* The main system(s) of rotating airfoils providing sustentation for the rotorcraft.

(e) *Antitorque rotor.* An auxiliary rotor which serves to counteract the effect of the main rotor torque on the rotorcraft.

(f) *Control rotor.* An auxiliary rotor, other than an antitorque rotor, which serves as a device by means of which the rotorcraft can be controlled in flight.

(g) *Plane of rotor disc.* A reference plane at right angles to the mechanical axis of rotation of the rotor.

(h) *Tip speed ratio.* The ratio of the rotorplane flight velocity component in the plane of the rotor disc to the rotational tip speed of the rotor blades.

$$\mu = \frac{V\cos\alpha}{\Omega R}$$

where:

V = air speed of the rotorcraft along flight path (feet per second)

α = angle between flight path and plane of rotor disc

Ω = Angular velocity of rotor (radians per second)

R = rotor radius (feet)

(i) *Load factor, n.* The ratio of any specific load on the rotorcraft to the rotorcraft design weight. When the load in question represents the net external load acting on the aircraft in a given direction, n represents the acceleration in that direction.

(j) *Limit load.* A load which it is assumed, or known, may be experienced but not exceeded in operation. From a design standpoint it is a load which the structure is capable of supporting without detrimental permanent deformations.

(k) *Factor of safety.* A factor by which limit loads are multipled to obtain ultimate loads.

(l) *Ultimate load.* A load which the structure is capable of carrying without failure (equal to the limit load multiplied by the factor of safety).

(m) *Primary structure.* Those portions of the aircraft the failure of which would seriously endanger the safety of the aircraft.

(n) *Fittings.* Fittings are defined as parts such as end terminals used to connect one structural member to another (see Table 6–1).

[Amdt. 06–0, 11 F. R. 6963, 7565]

§ 6.6 *Approval of materials, parts, processes, and appliances.* Materials, parts, processes, and appliances shall be approved upon a basis and in a manner found necessary by the Administrator to implement the pertinent provisions of this subchapter. The Administrator may adopt and publish such specifications as he finds necessary to administer this section, and shall incorporate therein such portions of the aviation industry, Federal, and military specifications respecting such materials, parts, processes, and applicances as he finds appropriate.

Any material, part, process, or appliance shall be deemed to have met the requirements for approval when it meets the pertinent specifications adopted by the Administrator, and the manufacturer so certifies in a manner prescribed by the Administrator.

[Amdt. 06–1, 12 F. R. 7899]

FLIGHT REQUIREMENTS

§ 6.10 *General.* All rotorcraft shall have such general performance and flight characteristics as to provide reasonable safety during the execution of any maneuver appropriate to, or necessary for, the aircraft and during steady flight at any weight, center of gravity position, speed, and power within the ranges for which the aircraft is certificated. Compliance with all performance requirements shall be demonstrated by suitable flight tests conducted by the applicant and witnessed by a representative of the Administrator of Civil Aeronautics or, at his discretion, conducted by that representative.

§ 6.11 *Landing.* It shall be possible to make a safe landing with all power off.

§ 6.12 *Ground handling.* The rotorcraft shall demonstrate satisfactory ground resonance characteristics.

STRENGTH CRITERIA

§ 6.20 *General.* (a) The primary structure shall be capable of supporting the ultimate loads without failure and shall be capable of supporting the limit loads for a period of at least 1 minute without detrimental permanent deformations.

(b) *Ultimate loads.* Ultimate loads are those obtained by multiplying the limit loads by the required factor of safety. The factor of safety shall be 1.5, except in cases where an additional (multiplying) factor of safety is specified. In such cases the final factor of safety shall be equal to 1.5 times the additional factor of safety.

(c) *Additional (multiplying) factors of safety.* The additional factors of safety specified in Table 6–1 shall be used where applicable. When more than one additional factor is indicated only the largest need be used.

(d) *Proof of structure.* Structural analyses, load tests, flight tests, dynamic tests, or combinations thereof, shall be made for the purpose of providing proof of compliance with the strength criteria.

(1) *Structural tests.* The following structural tests are required and shall be conducted in such manner as to substantiate clearly compliance with the strength criteria:

(i) Dynamic and endurance tests of rotors and rotor drives, including controls (see § 6.42 (a)),

(ii) Control surface and system tests (limit load and operation tests),

(iii) Vibration surveys (see §§ 6 22 and 6.24 (b)),

(iv) Landing gear drop tests (see § 6.21 (d) (1)),

(v) Such additional tests as may be found necessary by the Administrator to substantiate new and unusual features of the design.

§ 6.21 *Structural loading conditions*—(a) *General.* The airworthiness rating of a rotorcraft with respect to its strength will be based on the air speeds, rotor speeds, and load factors which can safely be developed in combination. The simultaneous air and rotor speeds which can safely be developed in combination with the specified load factors shall be determined by the applicant and shall serve as a basis for structural loading conditions and, where found necessary by the Administrator, for restricting the operation of the rotorcraft in flight.

(b) *Design limitations.* The following values shall be established by the applicant for purposes of showing compliance with the structural requirements specified in this section:

(1) Maximum design weight, W.

(2) Main rotor maximum tip speed ratio, μm (if the tip speed ratio for a helicopter in the autorotation phase exceeds that for power-driven conditions, then the former value shall be used),

(3) Main rotor(s) maximum design revolutions per minute, N.

(4) Auxiliary rotor(s) maximum design revolutions per minute. The limitation selected shall be such as to cover safely all normal operating ranges of the aircraft.

(c) *Flight loading conditions.* The flight load factors specified in subparagraphs (1) and (2) of this paragraph will represent rotor load factors. The net load factor acting at the center of gravity of the aircraft shall be obtained by proper consideration of balancing loads acting in the specific flight conditions.

(1) *Maneuvering flight conditions.* The rotorcraft structure shall be substantiated for a positive maneuvering limit load factor of 3.5 (resultant force on the rotor(s) equal to 3.5 times the rotorcraft design weight) and a negative maneuvering limit load factor of 1.0, except that lesser values may be used if the manufacturer can prove by analytical study and flight demonstrations that the values selected cannot be exceeded. In no case shall the limit load factors be less than 2.5 positive and 0.5 negative. The resultant force shall be assumed to be applied at the center(s) of the rotor hub(s) and to act in such directions as necessary to represent all critical maneuvering motions of the rotorcraft applicable to the particular type, including flight at the maximum design rotor tip speed ratio under power-on and power-off conditions.

(2) *Gust conditions.* The structure affected shall be substantiated for the loading due to vertical gusts of ±30 feet per second velocity in conjunction with the critical rotorplane air speeds, including hovering.

(d) *Ground loading conditions.* The structure shall be substantiated for the ground loading conditions specified in the current ANC–2 "Ground Loads Handbook," issued by the Army-Navy-Civil Committee on Aircraft Design Criteria, modified as necessary to suit the type of landing gear employed and character of landing operations undertaken by the rotorcraft. The structure shall be substantiated for a limit load factor not less than two-thirds of the value developed in energy absorption tests specified in subparagraph (1) of this paragraph.

(1) *Energy absorption.* The landing gear shall be capable of absorbing the energy of a free drop from a height of not less than 20 inches measured from the bottom of the tires to the ground, except that a lesser height may be used if the value chosen can be shown to exceed that corresponding to the greatest probable sinking speed at ground contact in power-off landings likely to be made by pilots of average skill. In no case shall the drop height be less than 12 inches. The weight of the rotor blades may be neglected in the drop test. The maximum drop test acceleration developed at the center of gravity shall be determined in the test.

§ 6.22 *Main rotor structure.* The requirements specified in paragraphs (a) to (e) of this section apply to the main rotor assembly(ies) including hub(s) and blades. The structure shall be substantiated for at least the following loading conditions:

(a) The hub(s), blades, blade attachments, and blade controls which are under cyclic flexing or alternating stresses shall be substantiated to demonstrate the airworthiness of these parts under repeated loading conditions associated with normal operation. The vibration stresses of critical metal parts shall be determined in flight and it shall be demonstrated that these stresses do not exceed safe values for continuous operation.

(b) The main rotor structure shall be substantiated for the critical flight condition loads specified in § 6.21 (c). At least the maximum design tip speed ratio condition shall be considered in conjunction with these limit loadings.

(c) The main rotor structure shall be substantiated for the limit loads specified by § 6.21 (c) under conditions of autorotation necessary for normal operation. The rotor r. p. m. used shall be such as to include the effects of altitude.

(d) The rotor blades, hub(s), and flapping hinges shall be substantiated for a loading condition simulating the force of blade impact against its stop during operation on the ground. A limit load acting at the center of gravity of the blade equal to the weight of the blade multiplied by a factor of 2.67 shall be used.

(e) The strength of the rotor assembly shall be substantiated for loadings simulating other critical conditions which may be encountered under normal operation. These shall include "jump-off", rotor "rev-up", and rotor "over-speed" conditions in flight.

§ 6.23 *Fuselage, landing gear, and rotor pylon structure.* The requirements specified hereunder apply to the fuselage, landing gear, and rotor pylon structure. The structure shall be substantiated for at least the following loading conditions:

(a) The structure shall be substantiated for the critical loads specified by § 6.21 (c). The resultant rotor force may be represented as a single force applied at the hub attachment point. Consideration shall be given to the balancing and inertia loads occurring under the accelerated flight conditions. The thrust from auxiliary rotors shall also be considered.

(b) The structure shall be substantiated for the ground loads specified by § 6.21 (d).

(c) The engine mount and adjacent fuselage structure shall be substantiated for loads occurring in the rotorcraft under the accelerated flight and landing conditions, including the effect of engine torque loads. In the case of engines having 5 or more cylinders, the limit torque shall be obtained by multiplying the mean torque by a factor of 1.5. For 4, 3, and 2 cylinder engines the factors shall be 2, 3, and 4, respectively.

§ 6.24 *Controls and control systems.* (a) The structure of all auxiliary rotors (antitorque and control), fixed or movable stabilizing and control surfaces, and all systems operating any flight controls shall be substantiated in accordance with the provisions of paragraphs (b) to (e) of this section.

(b) *Auxiliary rotor assemblies.* Auxiliary rotor assemblies shall be tested in accordance with the provisions of § 6.42 (a) for rotor drives. In addition, auxiliary rotor assemblies with detachable blades shall be tested for one hour at a speed equal to 1.4 times the speed at which the rotor is driven when the engine is operating at its maximum-except-take-off speed. In the case of auxiliary rotors with metal blades the vibration stresses shall be determined in flight and it shall be demonstrated that these stresses do not exceed safe values for continuous operation.

(c) *Auxiliary rotor attachment structure.* The attachment structure for the auxiliary rotors shall be substantiated for a limit load equal to the maximum balancing thrust of the rotor acting simultaneously with other loads on the structure occurring under critical maneuvering flight conditions.

The structure shall also be substantiated separately for a limit load equal to the maximum thrust of the rotor or rotors acting simultaneously with the maximum loads in the structure occurring under normal unaccelerated flight and landing conditions.

(d) *Stabilizing and control surfaces.* Stabilizing and control surfaces shall be substantiated for a minimum limit load of 15 pounds per square foot, or for a load due to $C_n=0.55$ at the maximum design speed, whichever is greater. The load distribution shall closely simulate actual pressure distribution conditions.

(e) *Primary control systems.* From the pilot's compartment to the point of their attachment to the rotor blades (or control areas) manual control systems shall be substantiated for the following minimum limit pilot forces:

(1) Foot type controls: 130 lbs.

(2) Stick type controls: 100 lbs. fore and aft, 67 lbs. laterally (the forces need not be applied simultaneously).

(3) Wheel type controls: 100 lbs. fore and aft, a couple equal to a 53-lb. pilot force applied on opposite sides of the control wheel.

§ 6.25 *Miscellaneous structures.* The strength of all structural items not specifically covered by preceding loading conditions shall be shown to be adequate for their intended purpose. In addition the following specific loading conditions shall be applied:

(a) (1) *Seat loads.* The strength of seats and their attachments to the primary rotorcraft structure shall be substantiated for passenger loads in the accelerated flight and landing conditions based on a standard passenger weight of 170 pounds.

(2) *Safety belt loads.* Structures to which safety belts are attached shall be capable of withstanding an ultimate load of 1,000 lbs. per person applied through the safety belt and directed upward and forward at an angle of 45 degrees with the floor line.

(b) *Local loads.* The primary structure shall be designed to withstand local loads caused by dead weights and by control loads transmitted through attachments. Baggage compartments shall be designed to withstand loads corresponding to the maximum authorized capacity. The substantiation of the adequacy of the structure to withstand dead-weight loads shall include a sufficient number of accelerated flight and landing conditions to insure that the most severe combinations have been investigated.

DETAIL DESIGN AND CONSTRUCTION

§ 6.30 *General.* The primary structure and all mechanisms essential for the safe operation of the rotorcraft shall not incorporate design details which on the basis of experience the Administrator has found to be unsafe. Certain design features which are essential to the airworthiness of a rotorcraft are hereinafter specified and shall be observed.

(a) *Materials and workmanship.* The primary structure shall be made from materials which experience or conclusive tests have proved to be uniform in quality and strength and to be otherwise suitable for rotorcraft construction. Workmanship shall be of sufficiently high grade as to insure proper functioning of all parts under reasonable service conditions.

(b) *Inspection provisions.* Means shall be provided to permit the examination of such parts of the rotorcraft as require periodic inspection.

(c) *Design of structural parts.* Structural parts shall be designed to avoid stress concentration which may affect adversely the strength of such parts in service, or which may introduce unknown factors into the stress analysis of the structure. Adequate fillets for this purpose shall be provided at all abrupt changes in section. Suitable allowances shall be made in the design for holes and for permissible variations in the location of holes. Joints which are likely to be subjected to appreciable wear shall be designed with replaceable bushings or allowances for oversize bolts or pins.

[Amdt. 06-0, 11 F. R. 6963, 7565]

§ 6.31 *Main rotor blades*—(a) *Pressure venting and drainage.* Internal pressure venting of the main rotor blades shall be provided. Drain holes shall be provided and, in addition, the blades shall be so designed as to preclude the possibility of water becoming trapped at any section of the blade.

(b) *Stops.* The rotor blades shall be provided with stops, as required for the particular design, to limit the travel of the blades about their various hinges.

NOTE: It is desirable that blades should never hit the droop stops except during starting and stopping the rotor.

(c) *Rotor and blade balance.* Rotors and blades shall be mass balanced to the degree necessary to prevent excessive vibrations and to safeguard against flutter at all speeds up to the maximum forward speed.

NOTE: Based on present design, practice blades should be mass balanced at each spanwise station to such a degree that an increase in blade section angle of attack will produce an increase in pitch reducing moment. (Additional general design information on this subject will be provided as experience with various rotorcraft designs is accumulated.)

§ 6.32 *Stabilizing and control surfaces; dynamic and static balance.* All control surfaces shall be dynamically and statically balanced to the degree necessary to safeguard against flutter at all speeds up to the maximum forward speed.

§ 6.33 *Control systems*—(a) *Installation.* All control systems shall be designed and installed to provide reasonable ease of operation by the crew and to preclude the probability of inadvertent operation, jamming, and interference by loose objects and passengers. All pulleys shall be provided with guards.

(b) *Stops.* All control systems shall be provided with stops which positively limit the range of motion of the pilot's controls. Stops shall be capable of withstanding the loads corresponding to the design conditions for the control system.

(c) *Autorotation control mechanism.* The main rotor blade pitch control mechanism shall be so arranged as to permit rapid entry into the autorotative regime of flight in the event of power failure.

§ 6.34 *Landing gear.* (See § 6.21 (d) (1).)

§ 6.35 *Fuselage and cabins*—(a) *Location of rotors.* All rotors shall be so located as not to endanger persons using passenger doors.

(b) *Pilot compartment.* The pilot compartment shall be so constructed as to afford adequate vision to the pilot under normal flying conditions. In cabin aircraft the windows shall be so arranged that they may be readily cleaned or easily opened in flight to provide forward and downward vision for the pilot.

(c) *Ventilation.* The ventilating system for the pilot and passenger compartments shall be so designed as to preclude the presence of excessive fuel fumes and carbon monoxide. The concentration of carbon monoxide shall not exceed 1 part in 20,000 parts of air under conditions of forward flight or hovering in zero wind. For other conditions of operation, if the carbon monoxide concentration exceeds this value, suitable operating restrictions shall be provided for the information of the crew.

(d) *Baggage compartments.* Each baggage and cargo compartment shall bear a placard stating the maximum allowable weight of contents, as determined by the structural strength of the compartment. Consideration shall be given to the effects of concentrated weights in the baggage compartments. Suitable means shall be provided to prevent the contents of cargo and baggage compartments from shifting.

POWER-PLANT INSTALLATION

§ 6.40 *General.* (a) The power-plant installation is considered to include all components of the rotorcraft which are necessary for its propulsion, with the exception of the structure of the main and auxiliary rotors.

(b) All components of the power-plant installation shall be constructed and installed in such a manner as to assure safe operation of the rotorcraft and shall be provided with all the controls and accessories necessary to assure such operation. Adequate accessibility shall be provided to permit the inspection and maintenance necessary to assure the continued airworthiness of all components of the power-plant installation. Fuel, oil, cooling, or other fluid systems shall be made of materials which, including their normal or inherent impurities, will not react chemically with any fuels, oils, or liquids that are likely to be placed in them.

§ 6.41 *Engine installation*—(a) *Engines.* The engine shall be of a type which has been type certificated or otherwise found eligible for use in certificated aircraft. (See Part 13 of this subchapter.)

(b) *Engine vibration.* The engine shall be installed in a manner to preclude harmful vibration of any engine parts or of components of the rotorcraft. It shall be demonstrated by means of a vibration investigation that the addition of the rotor and rotor drive system to the engine does not result in modification of engine vibration characteristics to the extent that the principal rotating portions of the engine are subjected to excessive vibratory stresses. It shall also be demonstrated that no portion of the rotor drive system is subjected to excessive vibratory stresses.

§ 6.42 *Rotor drive mechanism.* The rotor drive mechanism shall incorporate a unit which will automatically disengage the rotor drive and engine from the main and auxiliary rotors in the event of power failure. The rotor drive mechanism shall be so arranged that all rotors necessary for control of the rotorcraft in autorotative flight will continue to be driven by the main rotor(s) after disengagement of the engine and rotor drive from the main and auxiliary rotors.

(a) *Rotor drive and control mechanism endurance test.* (1) The rotor drive and control mechanism shall be tested for not less than 100 hours. The test shall be conducted on the rotorcraft and the power shall be absorbed by the actual rotors to be installed, except that the use of other ground or flight test facilities with any other suitable method of power absorption will be considered satisfactory provided all conditions of support and vibration closely simulate the conditions that would exist during a test on the actual rotorcraft. The endurance test shall consist of the following:

(i) Sixty hours at not less than maximum continuous engine speed in conjunction with maximum continuous engine power. In this test, the main rotor controls shall be set in the position which will give maximum longitudinal cyclic pitch change to simulate forward flight. The auxiliary rotor controls shall be in the position for normal operation under the conditions of the test.

(ii) Thirty hours at not less than 90 percent of maximum continuous engine speed and 75 percent of maximum continuous engine power. The main and auxiliary rotor controls during this test shall be in the same position as for paragraph (a) of this section.

(iii) Ten hours at not less than takeoff engine power and speed. The main and auxiliary rotor controls shall be in the normal position for vertical ascent during this test.

(2) All of the tests described in subparagraphs (1) (i), (ii), and (iii) of this paragraph may be conducted either on the ground or in flight. These tests shall be conducted for intervals of not less than 30 minutes except in the case of subparagraph (1) (iii) of this paragraph. The testing of subparagraph (1) (iii) of this paragraph may be accomplished in intervals of 5 minutes or more if desired.

(3) At intervals of not more than every 5 hours during the endurance tests the engine shall be stopped rapidly enough to allow the engine and rotor drive to be automatically disengaged from the rotors.

(4) Five hundred complete cycles of lateral control and 500 complete cycles of longitudinal control of the main rotors shall be accomplished under the operating conditions as specified in subparagraph (1) (i) of this paragraph. Five hundred complete cycles of control of all auxiliary rotors shall be accomplished under the operating conditions as specified in subparagraph (1) (i) of this paragraph. A complete control cycle is considered to involve movement of the controls from the neutral position, through both extreme positions, back to neutral position. The control cycling may be accomplished during the testing prescribed in subparagraph (1) (i) of this paragraph, or may be accomplished separately. The remainder of the testing prescribed in subparagraphs (1) (i) and (ii) of this paragraph shall be accomplished with the main rotor controls in the position which will give maximum longitudinal cyclical pitch change to simulate forward flight and with the auxiliary rotor controls in the position for normal operation under the conditions of the test. The part of the endurance test specified in subparagraph (1) (iii) of this paragraph shall be accomplished with the main rotor controls neutral and the auxiliary rotor controls in the position for normal operation in a vertical ascent under the power conditions of this portion of the test. Such additional dynamic, endurance, and operational tests or vibratory investigations shall be conducted as are found necessary by the Administrator to substantiate the airworthiness of the rotor drive mechanism.

(b) *Shafting critical speeds.* An investigation shall be made to determine that the critical speeds of all shafting lie outside the range of permissible engine speeds under idling, power-on, and autorotation conditions. It shall be demonstrated by actual operation that this condition is satisfied with the mechanism installed in the rotorcraft.

[Amdt. 06-0, 11 F. R. 6963, 7565]

§ 6.43 *Fuel systems*—(a) *Capacity and feed.* The fuel capacity shall be not less than 0.15 gallon per maximum (continuous) horsepower for which the rotorcraft is to be certificated. Air-pressure fuel systems shall not be used. Only gravity feed or mechanical pumping of fuel is permitted. The system shall be so arranged that, insofar as practicable, the entire fuel supply may be utilized in the steepest climb and at the best gliding angle and so that the feed ports will not be uncovered during normal maneuvers involving moderate rolling or sideslipping. The system shall also feed fuel promptly after one tank has run dry and another tank is turned on. If a mechanical pump is used, an emergency pump shall also be installed and shall be available for immediate use in case of a mechanical pump failure. Pumps of adequate capacity may also be used for pumping fuel from an auxiliary tank to a main fuel tank.

(b) *Tank installation.* Fuel tanks shall be separated from the engine compartment by a fire wall. At least one-half inch clear air space shall be provided between the tank and fire wall. Spaces adjacent to the surfaces of the tank shall be ventilated so that fumes cannot accumulate in the tank compartment in case of leakage. If two or more tanks have their outlets interconnected they shall be considered as one tank. The air spaces in such tanks shall be interconnected to prevent the flow of fuel from one tank to another as the result of a difference in pressure in the respective tank air spaces. Mechanical pump systems shall be so arranged that they cannot feed from more than one tank at a time.

(c) *Tank construction.* Each fuel tank shall incorporate a sump and drain located at the point in the tank which is lowest when the rotorcraft is in its normal ground position. The main fuel supply shall not be drawn from the bottom of this sump. All fuel tank outlets shall be provided with large-mesh finger strainers. Each tank shall be suitably vented from the top portion of the air space. Such air vents shall be arranged to minimize the possibility of stoppage by dirt or ice formation. Tanks of 10 gallons or more capacity shall be provided with internal baffles unless suitable external support is provided to resist surging.

(d) *Tank strength.* Fuel tanks shall be capable of withstanding, without failure or leakage, an internal pressure of either 3½ pounds per square inch, or the pressure developed during the maximum limit acceleration with fuel tanks, whichever is greater. Tanks shall be capable of withstanding, without leakage or failure, all vibration, inertia, and fluid loads to which they may be subjected in normal operation.

(e) *Fuel quantity gauge.* The fuel quantity gauge shall be so installed as to indicate readily to a pilot or a flight mechanic the quantity of fuel in each tank while in flight. When two or more tanks in a gravity feed system are closely interconnected and vented, and it is impossible to feed from each one separately, only one fuel quantity gauge need be installed. If a glass gauge is used, it shall be suitably protected against breakage.

(f) *Lines and fittings.* (1) All fuel lines and fittings shall be of sufficient size so that the fuel flow, with the fuel being supplied to the carburetor at the minimum pressure for proper carburetor operation, is not less than the following:

(i) For gravity feed systems: double the normal flow required to operate the engine at take-off power;

(ii) For pump systems: 1½ times the normal flow required to operate the engine at take-off power.

(2) A test for proof of compliance with the applicable flow requirements shall be conducted.

(3) All fuel lines shall be supported to prevent excessive vibration and should be located so that no structural loads can be applied. Bends of small radius or vertical humps in the lines shall be avoided. Copper fuel lines which have been bent shall be annealed before installation. Lines which are connected to components of the rotorcraft between which relative motion may exist shall incorporate provisions for flexibility. Flexible hose and fittings used in fuel line connections shall be of an approved type.

(g) *Strainers.* A strainer incorporating a sediment trap and drain shall be provided in the fuel system between the fuel tanks and the engine and shall be installed in an accessible position. The screen shall be easily removable for cleaning. If an engine-driven fuel pump is provided, the strainer shall be located between the fuel tank and the pump.

(h) *Valves.* A positive and quick-acting valve that will shut off all fuel to each engine individually shall be provided. The control for this valve shall be within easy reach of appropriate flight personnel. In the case of rotorcraft employing more than one source of fuel supply, provision shall be made for independent feeding from each source. The shut-off valve shall not be located closer to the engine than the remote side of the fire wall.

(i) *Drains.* One or more accessible drains shall be provided at the lowest point in the fuel system to drain completely all parts of the system when the rotorcraft is in its normal position on level ground. Such drains shall discharge clear of all parts of the rotorcraft and shall be equipped with suitable safety locks to prevent accidental opening.

(j) *Miscellaneous fuel system requirements*—(1) *Filler openings.* All fuel tank filler openings shall be plainly marked with the capacity, the word "fuel", and the minimum allowable fuel octane number for the engine installed. Provision shall be made to prevent fuel overflow from entering the compartments in which the fuel tanks are located.

(2) *Carburetor de-icing and anti-icing provisions.* Provisions shall be incorporated for preventing the formation and for the elimination of ice in the engine air induction system in accordance with the following:

(i) Rotorcraft employing sea level engines with conventional venturi carburetors shall be equipped with a carburetor air preheater capable of providing a heat rise of not less than 90° F. when the engine is operating at 75 percent of its maximum continuous power in air at a temperature of 30° F.

(ii) Rotorcraft employing altitude engines with conventional venturi carburetors shall be equipped with a carburetor air preheater capable of providing a heat rise of not less than 120° F. when the engine is operating at 75 percent of its maximum continuous power in air at a temperature of 30° F.

(iii) Rotorcraft employing altitude engines with carburetors embodying features which tend to prevent ice formation in the induction system shall be equipped with either one of the following:

(*a*) A carburetor air preheater capable of providing a heat rise of not less than 100° F. when the engine is operating at 75 percent of its maximum continuous power in air at a temperature of 30° F., or

(*b*) A carburetor air preheater capable of providing a heat rise of not less than 40° F. when the engine is operating at 75 percent of its maximum continuous power in air at a temperature of 30° F., together with a fluid de-icing system.

[Amdt. 06-0, 11 F. R. 6963, 7565]

§ 6.44 *Lubrication systems*—(a) *General.* Each engine shall have an independent oil supply. The oil capacity of the system shall be not less than either 1 gallon for every 25 gallons of fuel or 1 gallon for each 100 maximum (continuous) rated horsepower of the engine or engines, whichever capacity is greater. When suitable provisions are made to transfer oil between engines in flight or when a suitable reserve supply is provided the use of a smaller capacity oil system may be permitted. The suitability of the lubrication system shall be demonstrated in flight tests in which engine temperature measurements are obtained. The system shall provide the engine with an ample quantity of oil at a temperature suitable for satisfactory engine operation.

(b) *Tank installation.* Oil tanks shall be vented and shall be provided with an expansion space which cannot be inadvertently filled with oil. The expansion space shall be at least 10 percent of the total tank volume, except that it shall in no case be less than one-half gallon.

(c) *Tank strength.* Oil tanks shall be capable of withstanding an internal test pressure of 5 pounds per square inch without failure or leakage. Tanks shall be capable of withstanding, without leakage or failure, all vibration, inertia, and fluid loads to which they may be subjected in normal operation.

(d) *Quantity gauge.* A suitable means shall be provided to determine the amount of oil in the oil tanks during the filling operation.

(e) *Piping.* Oil piping shall have an inside diameter not less than the inside diameter of the engine inlet or outlet and shall have no splices between connections. All oil lines shall be so supported as to prevent excessive vibration and should be so located that no structural loads can be applied. Lines which are connected to components of the rotorcraft between which relative motion may exist shall incorporate provisions for flexibility. Flexible hose used in the oil system shall be of an approved type.

(f) *Drains.* One or more accessible drains shall be provided at the lowest point in the lubricating system to drain completely all parts of the system when the rotorcraft is in its normal position on level ground. Such drains shall discharge clear of all parts of the rotorcraft and shall be equipped with suitable safety locks to prevent accidental opening.

(g) *Oil temperature.* A suitable means shall be provided for measuring the oil temperature at the engine inlet during flight.

(h) *Filler openings.* All filler openings in the oil system shall be plainly marked with the capacity and the word "oil".

§ 6.45 *Cooling systems*—(a) *General.* The cooling system shall be capable of maintaining engine temperatures within safe operating limits under all conditions of flight during a period at least equal to that established by the fuel capacity of the rotorcraft, assuming normal engine power and speeds. Compliance with this requirement shall be demonstrated in flight tests in which engine temperature measurements are obtained under critical flight conditions. Such tests shall be conducted in air at temperatures corresponding to the highest anticipated summer air temperatures as specified in paragraph (b) of this section or, if the flight tests are conducted at temperatures that deviate from these temperatures, the recorded engine temperatures shall be corrected in accordance with the following:

(1) Cylinder head temperatures of air-cooled engines and engine oil inlet temperatures shall be corrected by adding the difference between the highest anticipated summer air temperature and the average temperature of the ambient air at the time of the first occurrence of the maximum cylinder head or oil inlet temperature recorded.

(2) Cylinder barrel temperatures of air-cooled engines shall be corrected by adding seven-tenths of the difference between the highest anticipated summer air temperature and the average temperature of the ambient air at the time of the first occurrence of the maximum cylinder barrel temperature recorded.

(b) *Highest anticipated summer air temperatures.* The temperatures employed in correcting engine temperatures observed in flight tests conducted to show compliance with the requirements of paragraph (a) of this section, shall be 100° F. at sea level and shall decrease from that value at the rate of 3.6° F. per thousand feet above sea level.

(c) *Radiators.* Radiators shall be so mounted as not to induce vibrations and strains causing distortion.

(d) *Piping.* Piping and connections shall conform to accepted standards and by their presence shall not induce vibration to the radiator or to the structure of the rotorcraft.

(e) *Drains.* One or more accessible drains shall be provided at the lowest point in any liquid cooling system to drain completely all parts of the system when the rotorcraft is in its normal position on level ground. Such drains shall discharge clear of all parts of the rotorcraft and shall be equipped with suitable safety locks to prevent accidental opening.

(f) *Filler openings.* All filler openings in the cooling system shall be plainly marked with the capacity of the system and the name of the proper cooling liquid.

§ 6.46 *Power-plant instruments, controls, and accessories*—(a) *Instruments.* The engine instruments required are specified in § 6.52.

(b) *Controls.* All power-plant controls, including those of the fuel system, shall be plainly marked to show their function and method of operation.

(1) *Throttle controls.* Throttle controls shall be easily accessible to both pilots and shall be so arranged as to afford a positive and immediately responsive means of controlling all engines both separately and simultaneously. Flexible throttle control systems shall be of an approved type. Throttle controls may be combined with the main pitch control if desired.

(2) *Ignition switches.* Ignition switches shall be easily accessible to both pilots. A positive means for shutting off quickly all ignition of multiengine rotorcraft, by grouping of switches or otherwise, shall be provided.

§ 6.47 *Manifolding, fire wall, and cowling or engine compartment covering*—(a) *General.* All manifolds, cowling, and fire walls shall be so designed and installed as to reduce to a minimum the possibility of fire either during flight or following an accident and shall comply with accepted practice in all details of installation not hereinafter specified.

(b) *Exhaust manifolds.* Exhaust manifolds shall be constructed of suitable materials, shall provide for expansion, and shall be so arranged and cooled that local hot points do not form. Exhaust gases shall be discharged clear of the cowling, rotorcraft structure, carburetor air intake, and fuel system parts or drains. Exhaust gases shall not discharge in a manner that will impair pilot vision at night due to glare. No exhaust manifolding shall be located immediately adjacent to or under the carburetor or fuel system parts unless such parts are properly protected against possible leakage.

(c) *Air intakes.* Carburetor air intakes shall be provided with suitable drains. Cold air intakes shall open completely outside the cowling unless the emergence of backfire flames is positively prevented. The air intake drain shall not discharge fuel in the possible path of exhaust flames.

(d) *Fire wall.* (1) The engine compartment shall be isolated from the remainder of the rotorcraft by means of fire-resistant bulkheads unless the engine is located in a nacelle which is remote from the remainder of the rotorcraft structure and contains no fuel tanks. The fire walls shall be constructed of one of the following materials, or of a material of equivalent fire-resistant qualities and strength characteristics:

(i) A single sheet of heat and corrosion-resistant steel not less than 0.012 inch thick;

(ii) A single sheet of nickel-chromium-iron alloy not less than 0.015 inch thick;

(iii) A single sheet of low carbon steel not less than 0.018 inch thick, coated with aluminum or otherwise protected against corrosion;

(iv) A single sheet of monel metal not less than 0.018 inch thick;

(v) A single sheet of terneplate not less than 0.018 inch thick;

(vi) Two sheets of aluminum alloy, each not less than 0.020 inch thick, which are separated by a sheet of asbestos millboard or asbestos fabric sheet not less than 0.125 inch thick, the entire assembly being adequately fastened together.

(2) The fire wall shall have all necessary openings provided with close-fitting, fire-resistant grommets, bushings, or fire wall fittings. Adjacent inflammable structural members or other inflammable components of the rotorcraft shall be protected by asbestos or other fire-resistant material and provisions shall be made to prevent fuel and oil from permeating the insulation.

(e) *Engine cowling and engine compartment covering.* All cowling or engine compartment covering shall be made of noninflammable material and shall be so arranged that any accumulations of dirt, waste, fuel, or oil may be readily observed without complete removal of the cowling or engine compartment covering. The cowling or covering shall fit tightly to the fire wall. However, openings may be provided if the surface of the aircraft within 15 inches of all such openings is protected with metal or other suitable fire-resistant material. The cowling or engine compartment shall be completely drainable in all operating attitudes of the rotorcraft. All drains shall discharge clear of the exhaust manifold, the path of the exhaust gases, and all parts of the rotorcraft.

(f) *Heating systems.* Heating systems involving the passage of cabin air over or in close proximity to engine exhaust manifolds shall not be used unless adequate precautions are incorporated in the design to prevent the introduction of carbon monoxide into the cabin or pilot compartment. Heat exchangers shall be constructed of suitable materials, shall be cooled adequately under all conditions, and shall be susceptible to ready disassembly for inspection.

§ 6.47-1. *Fire-resistant aircraft material (CAA rules which apply to § 6.74 (e)).* See § 4b.448-3 of this subchapter.

[Supp. 1, 13 F. R. 7737]

§ 6.48 *Fire protection*—(a) *Power-plant installation.* The power-plant installation shall be constructed and installed in such a manner as to preclude the possibility of fire.

(b) *Fire protection of flight controls.* All primary flight controls passing through the engine compartment shall be constructed of fire-resistant material, or shall be enclosed in a suitably ventilated and drained enclosure of 0.012 inch thick stainless steel, or material of equivalent fire-resistant qualities.

EQUIPMENT

§ 6.50 *General.* The equipment required shall be dependent upon the type of operation for which certification is desired. Basic minimum requirements are set forth below.

§ 6.51 *Acceptability.* Equipment items for which certification is required shall be certificated in accordance with the provisions of Part 15 of this subchapter. Other items of equipment shall be of a type and design found by the Administrator to be adequate for the purpose intended.

[Amdt. 06-0, 11 F. R. 6963, 7565]

§ 6.52 *Minimum equipment.* All rotorcraft shall be equipped with at least the following:

(a) An air-speed indicator.

(b) An altimeter.

(c) A tachometer for the main rotor or for each main rotor, the speed of which can vary appreciably with respect to another main rotor. (See § 6.53 (b).)

(d) A tachometer for each engine. (See § 6.52 (b).)

(e) An engine oil-pressure gauge when the engine employs a pressure oil system.

(f) A coolant thermometer for each liquid-cooled engine.

(g) An oil inlet temperature thermometer.

(h) A manifold-pressure gauge for each altitude engine.

(i) A fuel quantity gauge. (See § 6.43 (e) for requirements.)

(j) Certificated safety belts for all passengers and members of the crew. (See Part 15 of this subchapter for belt requirements and § 6.25 (a) (1) for installation strength requirements.)

(k) A device for measuring or indicating the amount of oil in the tanks. (See § 6.44 (d) for requirements.)

§ 6.52-1 *Air-speed indicators and altimeters (CAA rules which apply to § 6.52).* See §§ 4b.691-1 and 4b.691-8 of this subchapter.

[Supp. 1, 13 F. R. 7737]

§ 6.53 *Installation requirements*—(a) *General.* The required equipment shall be so installed as to function dependably.

(b) *Rotor and engine tachometers.* The tachometers required by § 6.52 (c) and (d) may be combined in a single instrument; however, such an instrument shall indicate rotor rpm during autorotation.

OPERATIONAL DATA

§ 6.60 *Operation limitations and information.* A flight manual shall be provided in the rotorcraft by which the operating personnel are informed of all operation limitations and information necessary for its safe operation. The manual shall include information essential to the proper maintenance of the rotorcraft.

§ 6.61 *Identification plate.* An identification plate shall be permanently affixed in a visible location in the pilot compartment of each rotorcraft. This plate shall contain the manufacturer's name, the model designation of the rotorcraft, its date of manufacture, and the manufacturer's serial number.

TABLE 6-1

[Additional (multiplying) factors of safety. See § 6.20 (c)]

Item	Component	Additional factor of safety	May be covered by item No.
1	Fittings (except control system fittings).[1]	1.15	2, 3, 4, 5, 6, 7.
2	Castings[2]	2.00	3, 4, 5.
3	Rotor hubs and blade attachments.	See § 6.22 (d).	
4	Control system joints (plain bearings).[3]	6.67	
5	Control surface hinges (plain bearings).[3]	1.50	
6	Torque tubes in direct bearing used as hinges.	1.50	
7	Ball and roller bearings in primary systems.	([4])	

[1] Fittings are defined as parts used to connect one primary member to another and shall include the bearing of those parts on the members thus connected. Continuous joints in metal plating and welded joints between primary structural members are not classified as fittings.

[2] A lower value than 2 will be acceptable where radiographic inspection is employed in accordance with a process specification approved by the Administrator.

[3] For bearing stresses only.

[4] For ball or roller bearings the manufacturer's non-Brinell rating shall equal or exceed the limit load.

PART 9—AIRCRAFT AIRWORTHINESS; LIMITED CATEGORY

AUTHORITY: §§ 9.1 to 9.3 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply sec. 601, 52 Stat. 1007; 49 U. S. C. 551.

SOURCE: §§ 9.1 to 9.3 contained in Civil Air Regulations, Amendment 09-0, 11 F. R. 14098, except as noted following section affected. Redesignated by SR-327, 13 F. R. 5486.

NOTE: This part is for the purpose of making available to the public certain military surplus aircraft which were originally designed for the military services of the United States for combat and other specialized purposes and which experience in military service has shown to be safe for operation so long as the operation is confined to flights in which neither passengers nor cargo are carried for hire.

§ 9.1 *Aircraft category.* Aircraft certificated in accordance with this part shall be classified in the limited category, suffix "L".

§ 9.2 *Type certificate; requirements for issuance.* A type certificate will be issued if the Administrator finds:

(a) The aircraft is of a make and model which was originally designed and has been manufactured for, and accepted for use by, the military services of the United States for combat or other specialized purposes.

(b) There is no civilian aircraft of essentially the same basic model for which an approved type certificate has been issued.

(c) That information obtained from the record of operation of the make and model as a military aircraft does not disclose any characteristics which would render it unsafe when operated as a civil aircraft in accordance with the limitations and conditions prescribed by the Administrator.

(d) Application is made for the type certificate prior to December 31, 1947.

§ 9.3 *Airworthiness certificate*—(a) *Requirements for issuance.* A limited airworthiness certificate will be issued by the Administrator for an aircraft eligible for a type certificate under this part if he finds, after inspection, that the aircraft is in a good state of preservation and repair and is in a condition for safe operation. Such inspection shall include a flight check by the applicant. Limited airworthiness certificates shall not be issued after August 31, 1948, to any aircraft which has not previously been so certificated.

(b) *Limitations.* The Administrator shall prescribe in the aircraft operating record such limitations and conditions as are necessary for safe operation of the aircraft.

[Amdt. 09-2, 13 F. R. 4999]

PART 13—AIRCRAFT ENGINE AIRWORTHINESS[1]

AUTHORITY: §§ 13.1 to 13.33 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply sec. 601, 52 Stat. 1007; 49 U. S. C. 551.

SOURCE: §§ 13.1 to 13.33 contained in Amendment 116, Civil Air Regulations, 6 F. R. 2868.

GENERAL

§ 13.1 *Scope.* The airworthiness requirements set forth in this part shall be used as a basis for determining the original eligibility of aircraft engines for use in certificated aircraft or for the issuance of type certificates therefor. Aircraft engines, when manufactured in accordance with, and conforming to, the aircraft engine specifications approved and in effect prior to August 1, 1941, of types having satisfactory safety records, will be eligible for use in certificated aircraft if such engines are in condition for safe operation.

§ 13.2 *Deviation.* Deviation from the requirements of this part may be permitted if it is clearly demonstrated that such deviation meets standards equivalent to or in excess of the requirements of this part in insuring safe operation.

§ 13.3 *Acceptance of Army or Navy requirements.* Equivalent requirements of the United States Army or Navy, with respect to airworthiness, may be accepted in lieu of the requirements provided in this part.

§ 13.4 *Inspection.* An authorized representative of the Administrator shall be permitted at any time and place to make such inspections and tests as are necessary to determine compliance with the requirements of this part.

AIRWORTHINESS REQUIREMENTS

§ 13.20 *Design and construction.* The engine shall be designed and constructed to function reliably under all flight and atmospheric conditions when properly installed, operated, and maintained in an aircraft.

(a) *Materials.* The engine shall be made of materials proved by experience or conclusive tests to be uniformly adequate in quality and strength, and otherwise suitable for the parts in which they are used.

[1] Civil Aeronautics Manual 13, which may be secured from the Correspondence Section, Civil Aeronautics Administration, Washington 25, D. C., sets forth in detail the Administrator's interpretations and explanations of the requirements of this part.

(b) *Fire prevention.* The engine shall be so designed and constructed, and materials of such quality shall be used, that the probability of the occurrence and spread of fire because of structural failure, overheating, or other causes, shall be reduced to a minimum.

(c) *Detail design.* The engine shall incorporate only details of design proved by experience or conclusive tests to be reliable and otherwise satisfactory for safe operation.

(1) *Durability.* The wearing surfaces, lubrication system and parts subject to fatigue shall be so designed and constructed that no unsafe condition will develop between overhaul periods when the engine is properly installed, operated and maintained in an aircraft.

(2) *Vibration.* The engine shall be designed and constructed to operate throughout its normal operating range of speeds and powers without excessive stress in the engine parts because of vibration, and without imparting excessive vibration forces to the engine support structure, when the engine is properly installed, operated, and maintained in an aircraft with a suitable flight propeller.

(3) *Fuel and induction system.* (i) The fuel system of the engine shall be designed and constructed to supply a satisfactory mixture under all flight and atmospheric conditions, during idling, acceleration, take-off, flight, and landing, when the engine is properly installed, operated, and maintained in an aircraft.

(ii) The intake passages of the engine through which air, or fuel in combination with air passes, for combustion purposes, shall be designed and constructed, insofar as possible, to avoid formation of ice deposits in such passages. The engine shall be designed and constructed so as to permit the use of a satisfactory means of ice prevention.

(4) *Ignition system.* All spark ignition engines shall be equipped with, (i) a dual ignition system having at least two spark plugs per cylinder and two separate electrical circuits having separate sources of electrical energy, or (ii) an ignition system which will function with equal reliability in flight.

(5) *Lubrication system.* The lubrication system of the engine shall be so designed and constructed that the system will function properly in all flight attitudes and atmospheric conditions in which the engine is intended to be used. In wet sump engines, such requirement shall be met when only one-half the maximum oil supply is in the engine. The system shall be so designed and constructed that provision can readily be made for properly cooling the oil.

(6) *Engine cooling.* The engine shall be designed and constructed to provide satisfactory cooling when the engine is properly installed, operated, and maintained in an aircraft.

(7) *Engine and accessory mounting attachments.* (i) The mounting attachments and structure of the engine shall have sufficient strength, when the engine is properly supported by a suitable engine mount structure, to meet the structural loading conditions of Part 4 of this subchapter, and to withstand vibration forces likely to occur.

(ii) Accessory mounting provisions and drives shall be designed and constructed to provide for the safe operation of the engine with the accessories attached. All essential engine accessories which may require inspection, adjustment, or removal between engine overhauls shall be mounted in such manner that they may be readily inspected, adjusted, or removed without disassembly of the engine.

§ 13.21 *Block testing.* The engine, including at least essential accessories, shall satisfactorily complete block testing as provided in this section under power outputs and conditions simulating the most severe flight operations possible when the engine is properly installed, operated and maintained in an aircraft. Separate engines of identical design and construction may be used for the endurance, calibration, and operation tests.

(a) *Testing equipment and personnel.* The applicant shall furnish suitable testing equipment and facilities, and competent personnel to conduct the required block tests.

(b) *Witnessing of tests.* An authorized representative of the Administrator shall witness all block testing sufficiently to ascertain that the information presented in the applicant's test report is substantially correct and complete. Such representative shall witness, in their entirety, the operation test, the calibration test, the tear-down inspections, and at least the last 50 hours of the endurance tests.

(c) *Engine operating conditions and limitations.* The engine operating conditions maintained within suitable tolerances or satisfactorily demonstrated during the testing shall determine the operating limitations to be assigned the engine by the Administrator. Such operating limitations shall include those necessary or advisable for safe operation of the engine, and may be placed on the following and any necessary additional items: power output, crankshaft speed, manifold pressure, spark and mixture settings, fuel and oil grades, and cylinder head, barrel, intake air, and oil inlet temperatures.

(d) *Calibration tests.* The engine shall be subjected to such calibration tests as are necessary to establish its power characteristics and the conditions under which it is to be endurance tested. Such tests shall cover, but need not be limited to, the proposed cruising, maximum-except-take-off, and take-off operating conditions.

(e) *Operation tests.* The engine shall be operated at various power outputs and speeds throughout the proposed operating range to demonstrate that the engine has satisfactory running and vibration characteristics, and freedom from detonation.

(f) *Endurance tests.* The endurance tests shall consist of the following 150 hours of testing on the same engine, in the order stated: (1) 50 hours at maximum-except-take-off power, (2) 50 hours at the most critical cruising conditions, (3) 40 hours at 91 percent take-off power or at least maximum-except-take-off power, and (4) 10 hours at take-off power. Such endurance tests shall be conducted in periods of not less than 30 minutes duration.

(1) *Engine adjustments and parts replacements.* (i) External adjustments and replacements of minor parts such as spark plugs, which are normally made in servicing aircraft engines, may be performed at reasonably spaced servicing periods designated in advance by the applicant.

(ii) Minor internal adjustments and replacements of minor parts, which are normally made during a top overhaul, may be performed during the optional 100-hour tear-down inspection.

(iii) The tests shall not be considered satisfactory if excessive adjustments or excessive replacements of minor parts are made, unless it is demonstrated that the causes therefor have been remedied.

(iv) Parts used to replace other parts, except as permitted by (i) and (ii) of this subparagraph, shall satisfactorily meet the 150-hour endurance tests: *Provided*, That the Administrator may accept other substantial equivalent proof of such parts.

(2) *Forced stops.* A forced stop is any malfunctioning of the engine or its essential accessories which would cause or make advisable an engine stop, including, but not limited to, structural failure, excessive increase in vibration, excessive leaking of fuel, oil, or coolant, or an appreciable decrease in performance not attributable to general wear or change in atmospheric conditions. When a forced stop occurs, appropriate corrective measures shall be taken to insure insofar as possible that similar malfunctioning will not reduce the reliability of the engine in service.

(g) *Optional tear-down inspection.* The applicant may, but shall not be required to, conduct a tear-down inspection after the completion of the first 100 hours of endurance testing.

(h) *Final tear-down inspection.* (1) At the completion of the endurance tests, the engine shall be completely disassembled and a detailed inspection made of the engine parts. Highly stressed parts shall be examined by suitable methods to determine the presence of hidden fatigue cracks. Wear measurements shall be taken and a comparison made of the final condition of parts and their condition prior to the beginning of the endurance tests or their dimensions as shown on the drawings. A conformity check consisting of a comparison of the parts of the engine tested with the drawings may be required at this time.

(2) If any part shows evidence of fatigue or impending failure or is otherwise not in a condition for safe operation, the engine will not be considered satisfactory unless appropriate corrective measures are taken and proven satisfactory by suitable testings: *Provided*, That the Administrator may accept other substantially equivalent proof.

(i) *Test report.* The applicant shall prepare and submit a suitable report completely covering the required testing of the engine and the tear-down inspections. Such report shall be signed by an authorized representative of the applicant and the authorized representative of the Administrator who witnessed the testing and tear-down inspections.

§ 13.22 *Identification plate.* A suitable identification plate shall be permanently attached to the engine in a location which will be readily accessible when the engine is installed in an aircraft. Such plate shall contain such pertinent information as may be prescribed by the Administrator.

§ 13.23 *Demonstration of compliance.* Compliance with the airworthiness requirements of this part shall be substantiated insofar as practicable by pertinent technical data and inspections. Analyses or additional tests satisfactory to the Administrator shall be made when warranted by unconventional design features or the results of block testing.

TYPE CERTIFICATE

CROSS REFERENCE: For regulations governing issuance of type certificates, see Part 2 of this subchapter.

§ 13.30 *Requirements.* In order to obtain an aircraft engine type certificate an applicant shall comply with the requirements of §§ 13.20–13.23 and §§ 13.31–13.33.

§ 13.31 *Data required.* In addition to the data required to show compliance with the airworthiness requirements, the applicant for a type certificate shall submit descriptive data adequate for the reproduction of other engines of the same type.

§ 13.32 *Changes.* When any change in design, construction, or operating limitations is made in an engine being manufactured under a type certificate, suitable data describing the change shall be submitted for the approval of the Administrator.

(a) *Major changes.* A major change is any change in design, construction, or operating limitations which might have an adverse effect on the reliability or other airworthiness characteristics of an engine. Proof adequate to show that a major change does not have such adverse effect shall be submitted to the Administrator. Engines incorporating major changes shall not be released for service until such changes are approved by the Administrator.

(b) *Minor changes.* A minor change is any change not within the definition of a major change. Adequate data describing each minor change shall be made conveniently available, in the manufacturing plant, to a representative of the Administrator at least by the time such change is released for production. The technical data file formally submitted to the Administrator shall be brought up to date insofar as such minor changes are concerned at least every 6 months.

§ 13.33 *Manufacturer's instructions.* The holder of a type certificate shall, within a reasonable time after receiving such certificate, prepare and submit for approval by the Administrator suitable instructions for the installation, operation, servicing, maintenance, repair and overhaul of the type certificated engine model or models. The holder of a type certificate shall make the approved instructions available to persons engaged in the operation, maintenance, repair or overhaul of engines manufactured under such certificate and shall prepare, submit for approval, and make available such revisions to the instructions as are found advisable from service experience.

PART 14—AIRCRAFT PROPELLER AIRWORTHINESS

AUTHORITY: §§ 14.1 to 14.54 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply sec. 601, 52 Stat. 1007; 49 U. S. C. 551.

SOURCE: §§ 14.1 to 14.54 contained in Civil Air Regulations, May 31, 1938, as amended by Amendment 75, 5 F. R. 3946, except as noted following sections affected.

GENERAL

§ 14.1 *Provisions for rating.* Pursuant to the provisions of the Civil Aeronautics Act of 1938, as amended, empowering and requiring the Civil Aeronautics Board to prescribe such minimum standards governing the design, materials, workmanship, construction, and performance of propellers as may be required in the interest of safety, and to provide for the rating of aircraft as to airworthiness, the requirements hereinafter set forth shall be used as the minimum standards for establishing such rating for propellers for use in certificated aircraft.

[Reg. 601–A–1, 3 F. R. 2052, as amended by Amdt. 75, 5 F. R. 3946]

§ 14.2 *Scope*—(a) *Airworthiness requisites.* To show eligibility of a propeller for certification the propeller shall meet the requirements of this part as to design, construction, and testing. The manufacturer shall comply with the requirements by the submission of technical data and by conducting tests with suitable test equipment. The applicable requirements are set forth in §§ 14.10–14.40.

(b) *Type certificate.* The general requirements for the issuance of a type certificate are set forth in Part 2 of this subchapter. The procedure relative to type certification of propellers is set forth in § 14.50.

(c) *Production certificate.* The requirements for the issuance of a production certificate are set forth in Part 2 of this subchapter.

(d) *Deviations.* When a propeller embodies a feature of design or construction which deviates from the practice in conventional screw propeller types, application shall be made to the Administrator for special rulings covering the feature in question.

§ 14.3 *Hubs and blades.* Interchangeable propeller hubs and blades are certificated as separate units and the word "propeller" as used in this part applies, where applicable, to a propeller hub and to a blade as well as to a complete propeller.

§ 14.4 *Testing facilities.* A manufacturer submitting a propeller for certification shall conduct all of the tests and supply or arrange for the testing facilities necessary to show compliance with the requirements contained in this part. When, in the opinion of the Administrator, adequate and satisfactory methods of testing other than those outlined herein are available, propellers tested by such methods may be eligible for certification.

§ 14.5 *Military propellers.* A propeller of a type which has passed the regular endurance tests of and is approved by the United States Department of the Air Force or the Bureau of Aeronautics, Department of the Navy, may be certificated in accordance with § 14.30.

§ 14.6 *Propeller operation limits.* A certificated propeller shall not be operated at a power or propeller shaft speed, or in conjunction with an engine bore, greater than the limits assigned thereto by the Administrator. The Administrator may specify short-time operation in excess of these limits for take-off purposes except that neither the power nor the speed limits will be raised by more than 10 percent without further testing.

§ 14.7 *Propeller identification data.* A certificated propeller, propeller blade, or propeller hub shall have the following information conspicuously displayed upon it: manufacturer's name; name, model designation, and serial number of the propeller. The identification data shall be permanently attached by means of a plate, stamping, engraving, etching, or other such method upon a noncritical surface of the propeller blade or hub. When such data are not visible when the propeller is assembled or installed on an aircraft they shall also be painted or printed on the propeller blade or hub.

[CAR, May 31, 1938, as amended by Amdt. 14–1, 10 F. R. 13199]

§ 14.8 *Previously approved propellers.* The regulations in this part supersede the requirements for approval of propellers set forth in previous regulations. However, propellers rated as suitable for use in approved aircraft in accordance with previous requirements may be used in certificated aircraft at the discretion of the Administrator.

DESIGN REQUIREMENTS

§ 14.10 *Propellers.* Propellers shall be so designed as to operate without excessive vibration or flutter and shall be constructed of materials which are suitable for service conditions.

§ 14.11 *Surface of propeller blade.* The surface of a propeller blade shall be smooth and the blade shall be faired with respect to the thickness and the moments of inertia about the major and minor axes, with no abrupt curvature changes or irregularities along the blade. Critical surfaces of a metal propeller hub shall be machined smooth without tool marks and any change in cross section shall be faired with as large a fillet as possible.

§ 14.12 *Inspection.* It is recommended that a propeller be so designed that the weakest portion of the propeller blade or hub may be inspected without disassembly and that excessive wear or a partial failure will precede a serious type of failure.

COMMERCIAL PROPELLERS

§ 14.20 *Data required.* In the case of a propeller of a type which has not been previously approved by the Department of the Army or Department of the Navy, and for which the manufacturer desires the certification of the Administrator, the following information shall be submitted:

(a) Application for type certificate on a form which will be supplied for the purpose by the Administrator.

(b) A complete set of drawings descriptive of the propeller, which drawings shall be numbered and dated and shall include change letters for each revision. All details of the propeller shall be shown, including the profile and plan form of the blade, the size of blade cross sections at frequent stations, the hub design, and the materials of construction. The material shall be specified on the drawings by reference to specification numbers of the Department of the Army, Department of the Navy, SAE, or other recognized standard whenever possible. If the manufacturer refers to his own specification numbers, details of such specifications shall be furnished the Administrator. All drawings shall be folded to a size of approximately 9 by 12 inches, with the title showing. In order to eliminate a possible source of controversy, the Administrator will not accept drawings which may be altered after approval. Blueprints, photostats, or the equivalent are acceptable. If certain of the drawings required for a particular propeller are identical with drawings previously submitted and approved in connection with a prior type of propeller made by the same manufacturer, such drawings need not be again submitted.

(c) A complete parts list in duplicate, showing the drawing number, change letter, and name of each component part of the propeller. The drawing numbers shall be listed in numerical order. When only one or two drawings are submitted for compliance with paragraph (b) of this section, it is permissible for the manufacturer to submit these drawings in duplicate in which case a parts list is not required.

(d) A complete log certified to by the person making the test or signed by a witnessing inspector of the Administrator, at the discretion of the Administrator, describing the manufacturer's tests of the propeller in accordance with § 14.21 or § 14.22, as the case may be. The log shall include a detailed record of the test with dates; names of persons involved; name and model number of engine, or name, model number, and identification mark of the airplane issued by the Administrator of Civil Aeronautics; and hours of testing with corresponding engine speeds. The report shall also include the results of a detailed inspection of the propeller after the test in accordance with § 14.23.

(e) A stress analysis when required by § 14.21 (b) or when, in the judgment of the Administrator, the design is sufficiently unconventional to require it.

[CAR, May 31, 1938 as amended by Amdt. 19, 4 F. R. 3391]

§ 14.21 *Tests required for propellers other than fixed pitch wood propellers.* (a) A propeller of such type shall be subjected to a 50-hour endurance block test on an internal-combustion engine rigidly mounted and of the same characteristics as the engine or engines in conjunction with which the propeller will be certificated for use, or on another engine acceptable to the Administrator. The test shall be witnessed by an authorized inspector of the Administrator and may be run without a stop or in periods of 5 hours or more each. The cylinder bore of the engine used for the test will determine the maximum bore of the engine with which identical propellers of this type will be certificated for use. The test shall be run at the proposed rated speed of the propeller with the propeller so adjusted as to absorb its proposed rated power. If the engine is not run at full throttle, and horsepower measurements are not possible during the test, manifold pressure readings shall be taken at frequent intervals. A suitable calibration curve shall be used to determine the power absorbed by the propeller during the test. The power rating assigned to the propeller by the Administrator may correspond to the corrected horsepower developed by the engine if the engine used for the test is of the type on which the propeller is to be certificated for use. In the case of a controllable or automatic pitch propeller, the pitch-changing mechanism shall be operated throughout the usable power range at least once for each hour of the test or the equivalent. The engine may be throttled to prevent overspeeding when changing pitch. After such 50 hours of testing, a controllable or automatic pitch propeller shall also be operated at as close to rated power and speed as possible for periods of 5 minutes each at various pitch settings, i. e., at 1 degree intervals throughout the operating range when the design so permits. All variations in running characteristics of the propeller shall be recorded.

(b) A propeller of the above type which, in the opinion of the Administrator, is sufficiently similar to a previously certificated propeller of the same manufacturer may be subjected to a 50-hour flight test in lieu of the test outlined in paragraph (a) of this section: *Provided,* That its airworthiness is demonstrated to the satisfaction of the Administrator by a comparative stress analysis submitted by the manufacturer. The stress analysis shall compare the pertinent aerodynamic, centrifugal, vibration, and torque impulse load differences between the respective propellers by a mathematical comparison, when possible, and by suitable curves plotted with the radius of the propeller as abscissa. Curves descriptive of the fairing of the propellers shall also be included when applicable. Such 50-hour flight test shall be conducted on an engine of equal or greater power and speed than that in conjunction with which the rating is requested. At least 5 hours of the test shall be run at the proposed rated speed of the propeller.

(c) It is recommended that metal propellers of this type also be tested by suitable methods to determine their natural frequencies within all ranges of major vibrations which are produced by the operation of the engines in conjunction with which such propellers are to be certificated for use. Such frequencies should be determined at all blade angles within the desired operating pitch range of propellers. Data covering these tests should be submitted to the Administrator in the form of curves and tables. The type of frequency should be described and the nodes located for each frequency.

§ 14.22 *Tests required for fixed pitch wood propellers.* A propeller of such type shall be subjected to a 10-hour endurance block test on an internal-combustion engine, or to a 50-hour flight test. The testing shall be witnessed by an authorized inspector of the Administrator at the discretion of the Administrator. In the case of a block test the entire test shall be run at the proposed rated speed of the propeller. In the case of a flight test at least 5 hours shall be run at the proposed rated speed of the propeller. Such flight test shall be conducted with an engine of equal or greater power and speed than that in conjunction with which the propeller is to be certificated for use.

§ 14.23 *Inspection of a tested propeller.* As prescribed in § 14.20 (d), the log of the flight or block test shall include the results of a detailed inspection of the propeller after the test. Photographs of any failures or suspected failures shall be included. A propeller which fails during the testing is not eligible for certification unless the failure is of a nature such that the strength of the propeller is not impaired and a minor modification to the propeller will preclude the probability of future failures of the same type. Aluminum-alloy propellers shall be etched at all critical portions and then examined for minute cracks with a magnifying glass. Steel propellers shall be subjected to both a magnetic and visual inspection for signs of failure.

(a) A failure of a metal propeller is defined as actual breakage, cracking or permanent set of any part of any blade, hub, bolt, lock nut, spline, or keyway; slipping of a blade in its clamping socket; seizing or pitting of any bearing; or jamming of an automatic or controllable pitch mechanism. A wood propeller will be deemed to have failed if the tipping pulls or cracks, if a glue joint opens, or if there is any local failure or crushing around the hub or a bolt. Similar considerations will apply to propellers of any patented composition or of other than conventional wood or metal construction.

PROPELLERS

§ 14.30 *Military propellers.* In the case of a propeller of a type which has previously been approved by the Army or Navy and for which the manufacturer desires certification by the Administrator, the following data shall be submitted:

(a) An application as described in § 14.20 (a).

(b) A copy of the official Army or Navy endurance test report which was the basis for the military approval, signed by the Army or Navy representative who witnessed the tests. It is not necessary for the manufacturer to submit this report when such report has been previously forwarded to the Administrator through official channels. When the report is being prepared by the military agency the Administrator, to expedite approval, may in the interim accept a copy of the official letter of approval of the propeller, which letter shall include the military rating, the length of test, and the output and model designation of the test engine.

(c) Drawings as described in § 14.20 (b).

§ 14.40 *Modified propellers.* When a manufacturer desires the certification by the Administrator of a propeller which embodies only minor modifications of a certificated propeller of the same manufacturer, data shall be submitted as follows:

(a) An application as described in § 14.20 (a).

(b) Drawings as described in § 14.20 (b).

(c) Technical data which demonstrate conclusively that the airworthiness of the modified propeller is at least equal to that of the certificated propeller.

PROCEDURE RELATIVE TO TYPE CERTIFICATION

§ 14.50 *General.* The procedure and general requirements for the issuance of a type certificate shall be as prescribed in Part 2 of this subchapter.

§ 14.51 *Sealed drawing list.* When a type certificate is granted, a drawing list representative of the certificated propeller is impressed with the seal of the Administrator of Civil Aeronautics and is returned to the manufacturer. Sealed copies of the drawings may be used for this purpose in lieu of a drawing list. Inspectors of the Administrator may call for, and must have access to, the sealed drawing list or drawings together with any other pertinent drawings when making an inspection of the manufacturer's plant to determine whether the propellers as built conform to the approved data.

[CAR, May 31, 1938, as amended by Amdt. 75, 5 F. R. 3946]

§ 14.52 *Major changes.* (a) Any major change from the approved drawings must be approved in advance by the Administrator. A change will be deemed major within the meaning of the regulations in this part if it adversely affects the reliability or airworthiness of the propeller. In general, a change will be deemed major when it decreases the airworthiness of a part the failure of which might prevent the aircraft from continuing flight. In all doubtful cases the decision of the Administrator shall establish the category within which a specific change will be included.

(b) Information accompanying a request for approval of a change to a certificated propeller shall include technical data, including (when necessary) stress analyses and reports of tests sufficient to demonstrate to the satisfaction of the Administrator that the changed propeller is airworthy. The report shall be signed and certified to by the responsible representative of the manufacturer. If the change is to a different blade shank size, engine shaft size, blade airfoil, or propeller material, application shall be made for a new type certificate.

[CAR, May 31, 1938, as amended by Amdt. 19, 4 F. R. 3391]

§ 14.53 *Minor changes.* On January 1 and July 1 of each year the holder of a propeller type certificate shall submit, for approval and file, drawings pertaining to all the minor changes made to the propeller during the preceding 6-month period.

§ 14.54 *Reductions in diameter.* A type certificate may provide for reduction in diameter from that of the propeller tested: *Provided*, That no increase in rating is involved. The diameter of a propeller blade may be reduced by cutting off the tip of the blade and fairing the immediate vicinity or by telescoping the outer sections of the blade. The drawings submitted shall show the details of each blade smaller in radius by 6-inch steps, which details may be shown superimposed on a drawing of the original blade.

PART 15—AIRCRAFT EQUIPMENT AIRWORTHINESS

AUTHORITY: §§ 15.1 to 15.51 issued under sec. 205 (a), 52 Stat. 984; 46 U. S. C. 425 (a). Interpret or apply sec. 601, 52 Stat. 1007, 49 U. S. C. 551.

SOURCE: §§ 15.1 to 15.51 contained in Civil Air Regulations, May 31, 1938, as amended by Amendment 75, 5 F. R. 3946, except as noted following sections affected.

GENERAL

§ 15.1 *Provision for rating.* Pursuant to the provisions of the Civil Aeronautics Act of 1938, as amended, empowering and requiring the Civil Aeronautics Board to prescribe such minimum standards governing appliances, including instruments, equipment, apparatus, parts, appurtenances, or accessories of whatever description, which are used, or are capable of being or intended to be used, in the navigation, operation, or control of aircraft in flight (including parachutes and communication equipment and any other mechanism installed in or attached to aircraft during flight), as may be required in the interest of safety, and to provide for the rating of aircraft and such appliances as to their airworthiness, the requirements hereinafter set forth shall be used as the minimum standards for establishing such rating of aircraft appliances for use in certificated aircraft.

[Reg. 601-A-1, 3 F. R. 2053, as amended by Amdt. 75, 5 F. R. 3946]

§ 15.2 *Scope of regulations.* (a) The regulations in this part shall apply to all important items of equipment which are manufactured as complete units and purchased by aircraft manufacturers and operators for use on certificated aircraft, except engines and propellers which are treated separately in Parts 13 and 14 of this subchapter, respectively.

(b) For the purpose of the regulations in this part an item of equipment shall be considered important if, by malfunctioning, it can endanger the safety of the aircraft, or the cargo or passengers in the aircraft, or persons or property beneath the aircraft.

(c) Because the development of aircraft specialties is constantly increasing in scope and variety, there undoubtedly will be developed, from time to time, important items of equipment for which specific provision is not made in the regulations in this part. In such cases the general procedure for certification will be in accordance with the regulations in this part and the manufacturer of the item in question shall apply to the Administrator for special rulings particularly applicable to it.

(d) The general requirements for the issuance of a type certificate are set forth in Part 2 of this subchapter. The procedure relative to type certification is set forth in § 15.6.

(e) The requirements for the issuance of a production certificate are set forth in Part 2 of this subchapter.

§ 15.3 *Classification of items of equipment.* (a) In view of the diversity of items of equipment and the variety of their uses, such items are grouped in two major classifications dependent upon the certification procedure applicable to the particular item.

(1) The certification procedure to be followed is similar for all items and differs only in detail in accordance with the classification within which a particular item lies.

(2) The specific installations in certificated aircraft of certificated items of equipment, irrespective of the classification used in this part, are subject in all cases to approval by the Administrator.

(b) It is desirable to certify a series of similar models of an item of equipment under one certification in order to eliminate as much clerical and identification work as possible. This may be done for some types of wheels, position lights, and other items, a series of which is similar in construction, and differ only in size and relatively unimportant structural details. This procedure may be applied to any item to which the manufacturer can show the procedure applicable.

(c) Items of equipment are classified as follows:

(1) Items of such design that they may be installed and used in any type or model of certificated aircraft, and for which type and production certificates, as defined in Part 2 of this subchapter, may be issued to manufacturers.

(2) Items of such design that they necessarily vary to suit one or more types or models of certificated aircraft in which they may be used. Type and production certificates will not be issued for such items. They will be specially approved as integral parts of the aircraft in which they are installed.

(d) Under paragraph (c) (1) of this section are included items such as the following:

Landing gear wheels.
Seaplane floats, excluding wing-tip floats.
Skis, including pedestals.
Position lights.
Landing flares.
Safety belts.
Parachutes.
Certain types of special flight and engine control units.
Control wheels.
Certain types of tail wheel knuckles.
Certain types of self-locking bolts and nuts, and parts of that general character.

(e) Under paragraph (c) (2) of this section are included items such as the following:

Automatic pilots.
De-icing equipment.
Landing gear shock absorber units.
Autogiro rotor hubs.
Wing ribs.
Fuel and oil tanks.
Engine cowls, wheel streamlines, propeller hub spinners and other special cowling.
Wing-tip floats.
Structures attaching seaplane floats to aircraft.
Special structures attaching skis to aircraft.
Heating and ventilating systems.

§ 15.3-1 *Automatic pilots (CAA rules which apply to § 15.3 (e)).* See § 4b.705-1 of this subchapter.

[Supp. 1, 13 F. R. 7737]

§ 15.4 *Factors affecting certification or special approval.* (a) All items of equipment falling within the meaning of the regulations in this part, irrespective of their classification, shall:

(1) Satisfactorily fulfill the purpose for which they are intended,

(2) Be free from undue hazard, both in themselves and in their method of operation,

(3) Be constructed of suitable and dependable materials, and

(4) Be manufactured and installed in accordance with the regulations in this subchapter so far as those regulations pertain to the particular item.

(b) Certain of the factors mentioned in paragraph (a) of this section may be demonstrated by drawings and analyses, others by drawings and tests, and others by visual inspection.

§ 15.5 *Identification data.* (a) Each type or model of an item of equipment for which certification is requested shall be assigned a model name or model number by the manufacturer such that it may be distinguished from all other types or models of items of equipment.

(b) Each unit of a certificated or specially approved type or model of equipment item shall be plainly and suitably marked to indicate that it has been certificated or specially approved. The applicable one of the following two methods shall be used to indicate this:

(1) If a type certificate has been issued to the manufacturer for the particular item, each unit shall bear the number of this type certificate.

(2) If a type certificate has not been issued to the manufacturer for the particular item, each unit shall bear the words "Administrator of Civil Aeronautics Approved" or an abbreviation thereof (ACAA).

(c) Each unit of a certificated or specially approved type or model of equipment item shall bear the following identification data:

(1) Manufacturer's name.

(2) Model number or model name.

(3) The serial number or date of manufacture of the particular unit, except that parachutes shall bear at least the date of manufacture.

(4) Administrator of Civil Aeronautics Type Certificate (or ACATC) No. ——, or Administrator of Civil Aeronautics Approved (or ACAA).

(5) Such additional information as is specifically provided for in the following regulations.

(d) The data prescribed in paragraph (c) of this section shall be displayed in a conspicuous place on the unit and in such a manner that it may not be easily erased, disfigured, or obscured. Any other information may be added by the manufacturer at his discretion.

[CAR, May 31, 1938, as amended by Amdt. 75, 5 F. R. 3946]

§ 15.6 *Procedure relative to certification or special approval.* (a) A request for certification or approval of a type or model, or, when possible, of a series of similar models of an item of equipment, shall be supported by the data specified in subparagraphs (1) to (4) of this section.

(1) A complete set of drawings descriptive of the item. Drawings of small standard commercial parts need not be submitted, but all other drawings applying to the item, including assembly drawings and, when necessary, installation drawings shall be submitted. The drawings shall contain all dimensions and material specifications of the item. Material shall be specified by reference to a specification number of the Army, Navy, SAE, or other such recognized standard whenever possible. If reference is made to material specifications which are not recognized standards, complete details of such specifications shall be submitted. Revision blocks on drawings shall designate the revision by letter and shall state the nature of the revision, the date and, when serial numbers are used, the serial number of the first unit manufactured in accordance with the revision. Title blocks on drawings shall contain the date of the original issue of the drawing and the drawing number. All drawings shall be folded to a size approximately 9 by 12 inches with the title block showing. In order to eliminate a possible source of controversy, the Administrator will not accept drawings which may be altered after approval. Blueprints, photostats, or their equivalent are satisfactory. These shall not contain pencil or ink notations. If certain of the drawings required for a particular model are identical with drawings previously submitted and approved in connection with a prior model made by the same manufacturer, such identical drawings need not again be submitted.

(2) A list, in duplicate, of all drawings applicable to the item. Such list shall include all drawings previously submitted and approved in connection with prior models made by the same manufacturer, which also apply to the model in question without change. The list shall be arranged in numerical order and shall designate each drawing by number, title, original date of issue, latest revision letter, and the model designation of the item for which the drawing was previously and originally submitted if for other than the model in question. Manufacturers' parts lists, if containing the information specified herein, are acceptable as drawing lists.

(3) Such additional data as are hereinafter prescribed for specific cases.

(4) The list specified in subparagraph (2) of this paragraph need not be submitted if the item for which certification is requested is described by only one or two drawings. In such a case, however, the drawings specified in subparagraph (1) of this paragraph shall be submitted in duplicate.

(b) If the item falls within the classification covered by § 15.3 (c) (1), the data submitted shall include a properly executed formal application for type certificate in accordance with Part 2 of this subchapter.

(c) If the item falls within the classification covered by § 15.3 (c) (2), complete information as to the make and model or makes and models of aircraft in which the item is to be installed shall be furnished, together with an application for special approval on a form which will be supplied for the purpose by the Administrator. If specific aircraft are involved, the information to be furnished shall include also the serial numbers and aircraft certificate numbers of the aircraft in question.

(d) Items of equipment which comply with the regulations prescribed in this part to the satisfaction of the Administrator may be certificated or approved, as the case may be, for use in certificated aircraft.

(e) If application for a type certificate has been made, certification is also contingent upon compliance with Part 2 of this subchapter to the satisfaction of the Administrator.

(f) Certification is subject to the provisions and restrictions stated on the type certificate and on the specification for the item issued as part of the type certificate, and approval is subject to the provisions and restrictions stated on the specification issued for the aircraft in which the item is installed.

(g) All manufactured units of a certificated or approved item of equipment shall be in exact accordance with the approved drawings and specifications.

(h) Changes or modifications to a certificated or approved item of equipment shall be approved by the Administrator in advance.

(i) A request for approval of a change or modification to a certificated or approved item of equipment shall be supported by revised or new drawings showing the changes; revised drawing list pages, in duplicate, showing the revised or new drawings; and technical data, including reports of any necessary tests, sufficient to demonstrate to the satisfaction of the Administrator that the changed or modified item is airworthy.

§ 15.7 *Previously approved items of equipment.* The regulations in this part supersede the requirements for approval of items of equipment set forth in previous regulations. However, items of equipment rated as suitable for use in approved aircraft in accordance with previous requirements may be used in certificated aircraft at the discretion of the Administrator.

LANDING GEAR EQUIPMENT

§ 15.11 *Landing gear wheels.* (a) Main landing gear wheels will be certificated for a maximum static load which will be determined from the strength of the wheel. Tail wheels will not be certificated.

(1) For the purpose of the regulations in this part main landing gear wheels are considered as those nearest the airplane center of gravity with respect to fore-and-aft location.

(2) For the purpose of the regulations in this part a tail wheel is considered as one which supports the tail of a conventional airplane in the three-point landing attitude.

(b) For wheels other than main landing or tail wheels, application shall be made to the Administrator for special rulings particularly applicable to the cases in question.

(c) The strength of a main landing gear wheel shall be substantiated by the following two static tests:

(1) Radial load test. (See subparagraph (3) of this paragraph.)

(2) Side load test. (See subparagraph (4) of this paragraph.)

(3) The required radial test load is equal to—

$$P \times n \times 1.5 \times 1.15$$

where P is the maximum static load for which approval is requested, n is

$$2.80 + \frac{9000}{2P + 4000}$$

and is the applied landing load factor for the corresponding airplane, 1.5 is the factor of safety, and 1.15 is a strength test material factor.

(4) The required side test load is equal to—

(0.35) × (the radial test load).

(5) The radial and side loads shall be applied separately and the wheel shall be equipped with the correct size tire inflated to the proper pressure for the load for which certification is requested.

(6) The radial load shall be applied to the wheel in the plane of the tire and may be distributed over a portion of the tire by allowing the tire to bear in a box of firm earth or sand.

(7) The side load shall be applied to the rim of the wheel at its maximum radius and may be distributed over an arc of not more than 30°. In order to insure sufficient strength in the retaining flanges of the rim, all the side load shall be applied to the inner flange in a direction such as to bend it away from the tire. In such case, the load must be increased so that its side component is equal to the load specified in subparagraph (4) of this paragraph. The wheel shall be restrained only by the axle.

(d) A main landing gear wheel shall support the required loads before failure.

(e) The rim contour of a main landing gear wheel shall conform to the Tire and Rim Association's standards or recommendations unless the wheel is to be used in conjunction with a specially constructed tire.

(f) A landing gear wheel may be equipped with any make or type of tire, *Provided*, That the tire is a proper fit on the rim of the wheel: *And provided*, That the tire rating of the Airplane Tire Committee of the Tire and Rim Association is not exceeded.

(g) Each unit of a certificated model of main landing gear wheel shall bear the following additional identification data as prescribed in § 15.5 (c) (5):

The maximum static load for which certificated.

(h) A request for certification of a type or model or series of models of main landing gear wheels shall be supported by the following additional data as prescribed in § 15.6 (a) (3):

(1) A report of the static tests prescribed in § 15.11 (c). The report shall contain complete details of the tests, including records of wheel deflections and photographs of the test set-ups. The report shall be signed by the person making the tests, and shall be certified to unless the tests were witnessed by an inspector of the Administrator, in which case such inspector also will sign the report as a witness.

[CAR, May 31, 1938, as amended by Amdt. 19, 4 F. R. 3391]

§ 15.12 *Brakes*—(a) *Testing of brakes for certification.* (1) A wheel-brake combination shall demonstrate satisfactory performance during 100 tests simulating the stopping of an airplane at an average deceleration of at least 10 feet per second per second, from a speed chosen by the applicant. The kinetic energy absorbed per stop shall be computed and the wheel-brake combination shall be certificated for a kinetic energy absorption not in excess of the amount so determined.

(2) To be eligible for use on airplanes certificated in accordance with the transport category requirements of Part 4a of this subchapter, a wheel-brake combination shall further demonstrate satisfactory performance during three tests identical with those specified in subparagraph (1) of this paragraph except that the speed shall be increased to obtain a kinetic energy absorption 125% of that determined under that subparagraph.

(b) *Adaptation of brakes to airplanes; transport category.* (1) An airplane certificated in accordance with the transport category requirements of Part 4a of this subchapter shall make use of wheel-brake combinations for which the summation of the kinetic energy ratings of the brakes used in the main landing gear is at least equal to:

$$K.E. = .0334\ W\ V_s^2$$

where:

$K.E.$ = kinetic energy in foot-pounds

W = the maximum landing weight of the airplane.

V_s = the power-off stalling speed of the airplane in miles per hour at sea level in standard air at maximum landing weight.

(2) The wheel-brake combinations used in such airplane shall have been tested, in determining the kinetic energy absorption under § 15.12 (a) from a speed lying between 80% and 100% of V_s.

(c) *Design.* Brakes shall be free from any undue tendency to lock or jam, and shall be suitably shielded from water, mud, and oil.

(d) *Static torque.* The maximum available static torque in reverse shall be at least 40% of the forward static torque when both are measured at the same applied pedal force.

(e) *Adjustment.* When necessary to insure satisfactory performance, the brake mechanism shall be equipped with suitable adjustment devices to compensate for disc or lining wear, heat, and other normal service effects.

(f) *Strength.* The brake and all of its attachments to the wheel shall be designed with an ultimate strength sufficient to withstand a torque which is 1.6 WR/B where R is the rolling radius of the tire and B is the number of brakes. A static test of the brake and wheel shall demonstrate that the assembly is capable of withstanding a torque which is 80% of the above without yielding to the point of impairing service operation.

(g) *Test log.* A log of the test runs shall be submitted together with other calculations which are necessary to indicate compliance with the brake regulations in paragraphs (a) to (f) of this section.

(h) *Identification data.* Each certificated brake shall bear the following identification as prescribed in § 15.5 (c) (5):

The foot-pounds of kinetic energy for which it is approved.

[Amdt. 15-2, 7 F. R. 3585]

§ 15.13 *Seaplane floats.* (a) Main seaplane floats will be certificated for a maximum gross weight of airplane which will be determined in accordance with the applicable requirements prescribed in Part 4a of this subchapter.

(1) Certification of a float does not include certification of the structure attaching it to the aircraft. Such structure is classified in accordance with § 15.3 (c) (2).

(2) The installation of floats on aircraft shall be in accordance with the provisions of Part 4a of this subchapter.

(b) Each unit of a certificated model of main seaplane float shall bear the following additional identification data as prescribed in § 15.5 (c) (5):

(1) The maximum gross weight of aircraft for which certificated.

(2) The number of floats per aircraft.

(c) A request for certification of a type or model or series of models of main seaplane floats shall be supported by the following additional data as prescribed in § 15.6 (a) (3):

(1) The technical data required to prove compliance with the applicable structural and detail design requirements prescribed in Part 4a of this subchapter.

§ 15.14 *Skis.* (a) Skis, including ski pedestals, will be certificated for a maximum static load which will be determined from the strength of the ski.

(1) Certification of a ski and its pedestal does not include certification of any special structure attaching it to the aircraft. Such structure is classified in accordance with § 15.3 (c) (2).

(2) The installation of skis on aircraft shall be in accordance with the provisions of Part 4a of this subchapter.

(b) The strength of a ski, including the pedestal, shall be substantiated by a stress analysis or by static tests.

(c) A ski, including the pedestal, shall be designed to carry the following loads without failure when supported at the pedestal bearing sleeve:

(1) A load upward, distributed uniformly along the ski bottom and symmetrically with respect to the pedestal bearing sleeve in the fore-and-aft direction, the front end of the ski carrying no load if it is at a greater distance from the bearing sleeve than the rear end. The required load is equal to—

$$P \times n \times 1.5$$

where P is the maximum static load for which approval is requested, n is

$$2.80 + \frac{9000}{2P + 4000}$$

and is the applied landing load factor for the corresponding airplane, and 1.5 is the factor of safety.

If the strength is substantiated by static test, the required test load is equal to—

$$P \times n \times 1.5 \times 1.15$$

where 1.15 is a strength test material factor.

(2) A load upward, applied to the ski bottom at a point directly under the pedestal bearing sleeve. The required load, or required test load, is equal to the load, or test load, specified in subparagraph (1) of this paragraph.

(3) A side load distributed uniformly along the edge of the ski bottom and symmetrically with respect to the pedestal bearing sleeve in the fore-and-aft direction, the front end of the ski carrying no load if it is at a greater distance from the bearing sleeve than the rear end. The required load, or required test load, is equal to 35 percent of the load, or test load, specified in subparagraph (1) of this paragraph. When the height of the aircraft axle from the ground with the ski installed is greater than the moment arm given in Figure 15-1 for the static load for which approval is requested, such side load may be reduced by the ratio of the moment arm given in Figure 15-1 to the height of the axle from the ground with the ski installed.

(4) A side load applied to the edge of the ski bottom at a distance forward of the axle equal to three times the pedestal height, except that if the pedestal height is less than the moment arm given in Figure 15-1 for the static load for which approval is requested, then the distance shall be three times the moment arm given in Figure 15-1. This side load shall be one-third the side load specified in subparagraph (3) of this paragraph.

(d) Each unit of a certificated model ski shall bear the following additional identification data as prescribed in § 15.5 (c) (5):

(1) The maximum static load for which certificated.

(e) A request for certification of a type or model or series of models of skis shall be supported by the following additional data as prescribed in § 15.6 (a) (3):

(1) A stress analysis of the ski and pedestal showing compliance with paragraph (c) of this section, if the strength of the ski and pedestal has been substantiated by a stress analysis. Such analysis shall be signed by the responsible engineer.

(2) A report of the static tests showing compliance with paragraph (c) of this section, if the strength of the ski and pedestal has been substantiated by static tests. The report shall contain complete load computations, complete details of the tests, and photographs of the test setups. The report shall be signed by the person making the tests and shall be certified to unless the tests were witnessed by an inspector of the Administrator, in which case such inspector also will sign the report as a witness.

[CAR, May 31, 1938, as amended by Amdt. 19, 4 F. R. 3391]

NAVIGATION APPLIANCES

§ 15.20 *Position lights*—(a) *General provisions.* Position lights prescribed in Part 4a of this subchapter, in order to be certificated, shall be so constructed and capable of being so mounted as to comply with the regulations hereinafter prescribed.

(1) A request for certification and such supporting data as may be prescribed in this section shall be accompanied by a complete set of lights described in the data. Such data shall include a copy of the instructions for the mounting of the lights in aircraft as furnished by the light manufacturer to purchasers.

(2) As the forward (right and left) lights are complementary they will be certificated as a unit. The rear (tail) light will be certificated as a separate unit.

(3) Forward lights are classified as follows:

(i) Standard forward position lights.

(ii) Air carrier forward position lights.

(iii) Auxiliary position lights.

(b) *Light distribution requirements.* See CAM 15 for diagrams.

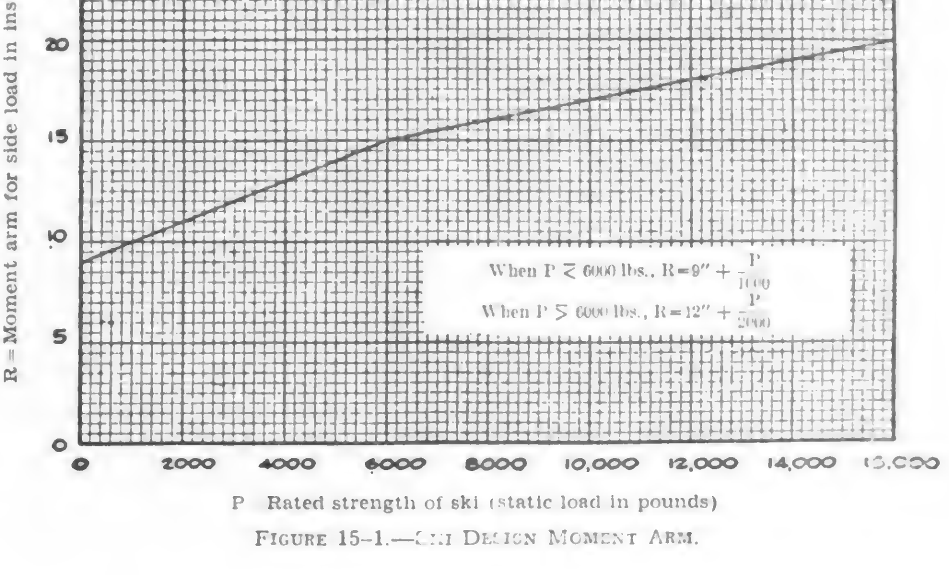

FIGURE 15-1.—SKI DESIGN MOMENT ARM.

(1) *Definitions.* Three dihedral angles hereinafter referred to as dihedral angle L, dihedral angle R, and dihedral angle A, are defined as follows: dihedral angle L is formed by the intersection of two vertical planes, one passing through the forward axis of the light unit, as defined in the mounting instructions, and the other at an angle of 110 degrees to the left when looking away from the unit; dihedral angle R is formed by the intersection of two vertical planes, one passing through the forward axis of the light unit, as defined in the mounting instructions, and the other at an angle of 110 degrees to the first, measured to the right when looking away from the unit; and dihedral angle A (aft) is formed by the intersection of two vertical planes making dihedral angles of 70 degrees to the left and 70 degrees to the right, respectively, of a vertical plane passing through the rear axis of the light unit, as defined in the mounting instructions. Each dihedral angle shall be understood to include the bounding planes as well as the space between the planes.

(2) *Standard forward position lights.* Each standard forward position light shall have an intensity of not less than three candles in all directions in dihedral angle L for the left light and in dihedral angle R for the right light. Within these dihedral angles, respectively, the intensity in all directions shall equal or exceed the minimum values given in Table I according to the angle between the direction of measurement and the forward axis of the unit.

TABLE I—MINIMUM PERMISSIBLE INTENSITIES IN ANY PLANE THROUGH THE FORWARD AXIS OF THE UNIT

At angles from forward axis not exceeding:	*Intensity*
60 degrees	4 candles
30 degrees	8 candles

In all directions in dihedral angle R for the right light and in dihedral angle L for the left light, tolerance of 10 degrees will be allowed in which the intensity of these lights shall be reduced to not over two candles. In these same directions a further tolerance of an additional 10 degrees will be allowed in which the intensity shall be reduced to not more than 0.5 candle. In all directions in dihedral angle A a tolerance of 10 degrees will be allowed in which the intensity of these lights shall be reduced to a maximum intensity of 0.5 candle. In all directions outside the specified dihedral angle and the allowed tolerance angles for each unit, the stray light intensity shall not exceed 0.5 candle.

(3) *Air carrier forward position lights.* Each air carrier forward position light shall have an intensity of not less than three candles in all directions in dihedral angle L for the left light and in dihedral angle R for the right light. Within these dihedral angles, respectively, the intensity in all directions shall equal or exceed the minimum values given in Table II according to the angle between the direction of measurement and the forward axis of the unit.

TABLE II—MINIMUM PERMISSIBLE INTENSITIES IN ANY PLANE THROUGH THE FORWARD AXIS OF THE UNIT

At angles from forward axis not exceeding:	*Intensity*
60 degrees	5 candles
30 degrees	10 candles
20 degrees	20 candles
15 degrees	30 candles
10 degrees	35 candles
5 degrees	40 candles

Within the same dihedral angles the intensities in the horizontal plane shall equal or exceed the minimum values given in Table III according to the angle between the direction of measurement and the forward axis of the unit.

TABLE III—MINIMUM PERMISSIBLE INTENSITIES IN THE HORIZONTAL PLANE THROUGH THE FORWARD AXIS OF THE UNIT

At angles from forward axis not exceeding:	*Intensity*
80 degrees	5 candles
40 degrees	10 candles
30 degrees	20 candles
20 degrees	30 candles
10 degrees	40 candles

In all directions in dihedral angle R for the right light and in dihedral angle L for the left light, a tolerance of 10 degrees will be allowed in which the intensity of these lights shall be reduced to not over 10 candles. In these same directions a further tolerance of an additional 10 degrees will be allowed in which the intensity shall be reduced to not more than 1 candle. In all directions in dihedral angle A a tolerance of 10 degrees will be allowed in which the intensity of these lights shall be reduced to not more than 1 candle. In all directions outside the specified dihedral angle and the allowed tolerance angles for each unit, the stray light intensity shall not exceed 1 candle.

(4) *Auxiliary forward position lights.* Each auxiliary forward position light shall have an intensity of not less than 20 candles in all directions not exceeding 30 degrees of the forward axis of the unit, measured in dihedral angle L for the left unit and in dihedral angle R for the right unit. Within the afore-described angles the intensity in all directions shall equal or exceed the minimum values given in Table IV according to the angle between the direction of the measurement and the forward axis of the unit.

TABLE IV—MINIMUM PERMISSIBLE INTENSITIES IN ANY PLANE THROUGH THE FORWARD AXIS OF THE UNIT

At angles from forward axis not exceeding:	*Intensity*
20 degrees	30 candles
10 degrees	40 candles

In all directions in dihedral angle R for the right light and in dihedral angle L for the left light, a tolerance of 10 degrees will be allowed which the intensity of these lights shall be reduced to not over 8 candles. In these same directions a further tolerance of an additional 10 degrees will be allowed in which the intensity shall be reduced to not more than 0.5 candle. In all directions in dihedral angle A the maximum intensity shall be less than 0.5 candle. In all directions outside the specified dihedral angle and the allowed tolerance angles for each unit, the stray light intensity shall not exceed 0.5 candle.

(5) *Non-air carrier airplane rear position lights.* Each rear position light shall have an intensity of not less than 4 candles in dihedral angle A. Within this dihedral angle the intensity in all directions not exceeding 70 degrees from the rear axis of the unit shall be not less than 8 candles. In all directions in dihedral angle L and in dihedral angle R, a tolerance of 20 degrees will be allowed in which the intensity of this light must be reduced to a maximum stray light intensity of 1 candle. In all directions outside the specified dihedral angle and the allowed tolerance angles, the stray light intensity shall not exceed 1 candle.

(6) *Air carrier airplane rear position lights.* Air carrier airplane rear position lights shall emit an alternate aviation red and aviation white flash repeated at a frequency of 40 cycles a minute, each cycle having characteristics prescribed by the Administrator. Both white and red lights shall be fitted with 32-candlepower lamps. The red and white units of the light may be separate units spaced as closely as possible. Each color of light shall be completely visible in dihedral angle A. If separate red and white units are used, certificated white tail lights may be converted into such units as follows: (i) The candlepower of the lamps shall conform to the requirements of this section, (ii) the clear cover glass for the intended red unit shall be replaced by a red cover glass of the same design. No photometric tests of such converted lights will be considered necessary when the above changes are made. If the light is of a new type, it shall emit light in all directions in dihedral angle A, as specified in subparagraph (5) of this paragraph.

(c) *Color.* All left forward position lights shall be aviation red, all right forward position lights shall be aviation green, and all rear position lights for non-air carrier aircraft shall be aviation white. These colors are defined as follows:

(1) Aviation red is a color having the following ICI chromaticity coordinates:

y is not greater than 0.335 and
z is not greater than 0.002

(2) Aviation green is a color having the following ICI chromaticity coordinates:

x is not greater than $0.440-0.320y$
x is not greater than $y-0.170$ and
y is not less than $0.390-0.170x$

(3) Aviation white is a color having the following ICI chromaticity coordinates:

x is not less than 0.350
x is not greater than 0.540
$y-y_0$ is not numerically greater than 0.01
y_0 being the y coordinate of the Planckian radiator for which $x_0=x$.

(d) *Light covers.* The lamp and reflectors shall be protected by a cover which shall be of noncombustible material and so constructed that it will not change color or shape, or cloud, or suffer any considerable loss of transmission in normal use. The coloring of those portions which are intended to transmit light shall be completely diffused through the material.

[Amdt. 20, 4 F. R. 3453, as amended by Amdt. 15-1, 7 F. R. 1710 and 11 F. R. 1267]

§ 15.21 *Landing flares.* (a) Landing flares prescribed in Part 4a of this subchapter, in order to be certificated, shall be so constructed and capable of being so mounted as to comply with the regulations prescribed in this part.

(1) The installation of landing flares in aircraft shall be in accordance with the provisions of Part 4a of this subchapter, and the flare manufacturer's mounting instructions.

(b) Landing flares will be certificated with respect to their light duration and light intensity. They are grouped in three classifications as follows:

(1) Class 1 flares.
(2) Class 2 flares.
(3) Class 3 flares.

(c) Class 1 flares shall have a light duration of at least 3 minutes, a light intensity of at least 200,000 candlepower and a rate of descent not greater than 550 feet per minute.

(d) Class 2 flares shall have a light duration of at least $1\frac{1}{2}$ minutes, a light intensity of at least 110,000 candlepower, and a rate of descent not greater than 550 feet per minute.

(e) Class 3 flares shall have a light duration of at least 1 minute, a light intensity of at least 70,000 candlepower, and a rate of descent not greater than 550 feet per minute.

(f) Each unit of a certificated model landing flare shall bear the following additional identification data as prescribed in § 15.5 (c) (5):

(1) The class for which certificated.

(g) Upon satisfactory completion of the examination of the technical data submitted to the Administrator, five flares of each model described in the data, an airplane arranged for the complete installation of flares of each model, and operating personnel shall be made available for functional tests of the flares. These tests may be made at any location desired by the manufacturer.

(1) In the event that there is one failure out of the five flares subjected to functional tests, five additional flares shall be subjected to functional tests.

(2) Failure of two or more flares out of 10 dropped shall be sufficient grounds for denial of certification by the Administrator. Certification will be made only if all five original flares function satisfactorily or, in the event of one failure in the original five, if the second five function satisfactorily.

SAFETY EQUIPMENT

§ 15.30 *Safety belts.* (a) Safety belts will be certificated for general aircraft use or for glider use dependent upon the strength of the belt.

(1) Certification of a safety belt does not include certification of its anchorages to the aircraft.

(2) The installation of safety belts in certificated aircraft shall be in accordance with the pertinent provisions of Part 4a of this subchapter.

(b) Safety belts shall be so designed as to be easily adjustable. Each belt shall be equipped with a quick-release mechanism so designed that it cannot be released inadvertently. The width of a certificated safety belt shall be at least 2 inches.

(c) The strength of a safety belt shall be determined by static test.

(d) Safety belts for general aircraft use will be certificated for one person or two adjacent persons dependent upon the strength of the belt.

(1) A safety belt for one person shall be capable of withstanding a load of 1,000 pounds applied in the same manner as a person's weight would be applied in a crash. The quick-release mechanism shall be capable of withstanding this load without undue distortion, so that when the load is relieved to 400 pounds the mechanism shall be capable of being operated by hand.

(2) A safety belt for two persons shall be capable of withstanding a load of 2,000 pounds applied in the same manner as the weight of two persons would be applied in a crash. The quick-release mechanism shall be capable of withstanding this load without undue distortion, and when the load is relieved to 800 pounds the mechanism shall be capable of being operated by hand.

(e) Safety belts for glider use only will be certificated as such.

(1) A safety belt for glider use shall be capable of withstanding a load of 850 pounds applied in the same manner as a person's weight would be applied in a crash. The quick-release mechanism shall be capable of withstanding this load without undue distortion, and when the load is relieved to 400 pounds the mechanism shall be capable of being operated by hand.

(f) Each unit of a certificated model safety belt shall bear the following additional identification data as prescribed in § 15.5 (c) (5):

(1) Whether for one person, two persons, or for glider use only.

(g) A request for certification of a type or model or series of models of safety belts shall be supported by the following additional data as prescribed in § 15.6 (a) (3):

(1) A report of the static tests showing compliance with paragraph (c) (1), (c) (2), and (e) (1) as the case may be. The report shall contain complete details of the tests, including the hand operation of the quick-release mechanism under relieved load, and shall contain photographs of the test setup. The report shall be signed by the person making the tests and shall be certified to unless the tests were witnessed by an inspector of the Administrator, in which case such inspector also will sign the report as a witness.

[CAR, May 31, 1938, as amended by Amdt. 19, 4 F. R. 3391]

§ 15.31 *Parachutes.* (a) Parachutes prescribed by the regulations in this subchapter in order to be certificated, shall be so constructed as to comply with the following regulations.

(1) All materials used shall be equivalent to or better than those specified by the United States Army or Navy for parachutes, or shall be proved satisfactory to the Administrator by technical data and practical tests.

(2) The follow-through between parachute and rider shall be so engineered that all parts or fittings carrying a shock load are stronger than the combined strength of the suspension lines to which they are attached.

(3) All metal parts shall be designed to carry their full rated load without yielding.

(4) The fabric used in the canopy construction shall be free from gums, starches, and other foreign material. It shall also be free from avoidable imperfections in manufacture and from defects or blemishes affecting its strength or durability and shall have been finished without application of excessive heat. The surface of the fabric shall be smooth.

(5) Suspension lines shall be continuous, without splices, from connector link to connector link and shall contain no knots between these points.

(6) Before securing the suspension lines to the skirt, each line shall be put under 40 pounds tension and marked to show the point of attachment. The fabric shall be pulled out but not stretched.

(7) The machine sewing shall be made with a shuttle or plain stitch. All zigzag sewing shall be done on a 2-stitch sewing machine.

(8) The rip cord, including joints between the handle and the release, shall be designed to withstand a load of 300 pounds.

(9) The harness shall be so constructed that the rider can release himself and drop clear in case of a water landing, but a quick-attachable or quick-releasing device between the harness and the parachute is not mandatory.

(10) Each parachute outfit shall be provided with a suitable place for keeping a record card containing spaces for recording dates of repacking, repairs, by whom made, and space for the manufacturer's recommendations as to repacking.

(b) Deviations from paragraph (a) (5), (6), (7) of this section shall be such as are acceptable to the United States Army or Navy, or shall be proved satisfactory to the Administrator by technical data and practical tests.

(c) A request for certification of a type or model or series of models of parachutes shall be supported by the following additional data as prescribed in § 15.6 (a) (3):

(1) Data showing compliance with subparagraphs (a) (1)–(a) (10) of this section. These data may be references to drawings submitted if the drawings clearly show compliance with the regulations in this part.

(2) Data substantiating any deviations in accordance with paragraph (b) of this section.

(3) A detailed list of the material and strength specifications of all component parts of the parachutes described in the drawings. The list shall also specify the manufacturing practices employed in the assembly operations and shall satisfy the Administrator that all parts are properly pull-tested before assembly.

(d) Upon satisfactory completion of the examination of the technical data submitted to the Administrator of Civil Aeronautics, parachutes of each model described in the data, together with an airplane and operating personnel, shall be made available for the following tests of the parachutes. These tests may be made at any location desired by the manufacturer.

(1) *Functional test (normal pack).* Twelve drops from an airplane with a 170-pound dummy man, from an altitude of not more than 500 feet. The indicated air speed of the airplane at the time of release shall be 70 miles per hour. No twists shall purposely be packed in the suspension lines. The parachute must be fully open within 3 seconds from time of release.

(2) *Functional test (twisted lines).* Five drops from an airplane with a 170-pound dummy man, from an altitude of not more than 500 feet. The indicated air speed of the airplane at the time of release shall be 70 miles per hour. Three twists shall purposely be packed in the suspension lines near the skirt. The parachute must be fully open within 4 seconds from time of release.

(3) *Strength test.* Three drops with the same parachute with a 600-pound lead weight, from an airplane at an altitude of not more than 500 feet. The indicated air speed of the airplane at the time of release shall be 100 miles per hour. No twists shall purposely be packed in the suspension lines. The weight shall be attached to the harness. No external shock absorbers or material which may act as such shall be permitted. The parachute shall show no failure of any material.

(4) *Live drop tests.* Two live drops from an airplane with a 170-pound man, from an altitude of 2,000 feet on a comparatively still day. An additional certificated auxiliary parachute shall be carried. The rider must suffer no discomfort from opening shock and must be able to disengage himself from the harness after landing.

(5) *Rate of descent test.* One drop from an airplane with a 170-pound dummy man, from an altitude of 2,500 feet. The rate of descent shall not exceed 21 feet per second. The descent shall be timed from the time of full opening to the time of ground impact. The distance descended shall be assumed at 2,250 feet and the rate of descent shall be this distance divided by the time in seconds.

(6) *Test performance requirement.* One hundred percent performance shall be required in the tests specified in subparagraphs (1) to (5) of this paragraph, except in the case of an auxiliary parachute. (See paragraph (f) of this section.)

(e) The tests specified in paragraph (d) of this section will not be required for parachutes previously approved by the United States Army Air Corps or by the Bureau of Aeronautics, Navy Department. In lieu of these tests, there shall be included in the supporting data submitted with a request for certification of such a parachute the following data:

(1) A copy of the official report describing the drop tests and static tests which formed the basis of the Army or Navy approval, signed by the Army or Navy representatives who witnessed the tests.

(2) A statement by an authorized representative of the Army or Navy to the effect that the parachute is approved and accepted by the Army or Navy as the case may be.

(f) A parachute to be certificated for use as an auxiliary parachute in combination with a certificated parachute need not comply with the rate of descent specified in subparagraph (d) (5) of this section, but shall have a rate of descent not exceeding 25 feet per second and shall comply with all of the other regulations prescribed in this part.

(1) The technical data submitted in connection with an auxiliary parachute and the tests made to obtain its certification shall satisfactorily account for the combination of parachutes and not the auxiliary parachute alone.

(2) Each unit of a certificated model auxiliary parachute shall bear the following additional identification data as prescribed in § 15.5 (c) (5): "Auxiliary only."

CONTROL AND STRUCTURAL UNITS

§ 15.40 *General.* (a) Certain types of special control units and structural units, such as those listed in § 15.3 (d), so designed that they can be used in any type or model of aircraft without change or with only minor changes which in no way affect the operation or strength of the units, will be certificated: *Provided,* That they comply with the regulations applicable to them prescribed in Part 4a of this subchapter.

(1) The installation of such special units in aircraft shall be in accordance with the pertinent provisions of Part 4a of this subchapter and the instructions of the manufacturers of the units.

(b) Before requesting certification of a type or model, or series of models, of a special control unit or structural unit, the manufacturer shall apply to the Administrator for a ruling as to the additional data to be submitted in accordance with § 15.6 (a) (3) to show compliance with the regulations applicable to the unit in question prescribed in Part 4a of this subchapter. This application shall be accompanied by a description of the unit and a drawing, or drawings, sufficient to enable the Administrator to make a ruling particularly applicable to the unit in question.

EQUIPMENT ITEMS ADAPTED TO SPECIFIC AIRCRAFT MODELS

§ 15.50 *Equipment items adapted to only one aircraft model.* (a) Certain items of equipment, such as those listed in § 15.3 (e), so designed that they can be used only in one aircraft model will be specially approved as integral parts of the aircraft in which they are installed: *Provided,* That they comply with the regulations applicable to them prescribed in Part 4a of this subchapter.

(b) A request for approval of such an item of equipment shall be supported by the following additional data as prescribed in § 15.6 (a) (3):

(1) Data showing compliance with the regulations applicable to the item in question prescribed in Part 4a of this subchapter.

(2) In lieu of the data specified in subparagraph (1) of this paragraph, data in accordance with a special ruling made by the Administrator and obtained by the procedure prescribed in § 15.40 (b).

(c) The request for approval of such an item of equipment together with its supporting data shall be included with the approval request and supporting data for the aircraft model in which the item is installed.

§ 15.51 *Equipment items adapted to any aircraft model by means of detail design changes.* (a) Certain items of equipment, such as those listed in § 15.3 (e), of such a nature that by means of detail design changes they can be used in any aircraft model, will be specially approved as integral parts of the aircraft in which they are installed: *Provided,* That they comply with the regulations applicable to them prescribed in Part 4a of this subchapter.

(b) If the manufacturer so desires, such an item of equipment may be considered as a series of items, each so designed that it can be used only in one aircraft model. Approval in such a case will be handled as prescribed in § 15.50.

(c) If the procedure prescribed in paragraph (b) of this section is too cumbersome to suit a particular item, the item will be considered in two parts as follows:

(1) The unchanged basic structure.

(2) The variable structure.

(d) If the basic structure is deemed satisfactory by the Administrator, only the variable structure need be considered in connection with the certification of each aircraft model in which the item is installed.

(e) A request for examination of the basic structure of such an item of equipment shall be supported by the following additional data as prescribed in § 15.6 (a) (3):

(1) Data showing compliance with the regulations applicable to the item in question prescribed in Part 4a of this subchapter.

(2) In lieu of the data specified in subparagraph (1) of this paragraph, data in accordance with a special ruling made by the Administrator and obtained by the procedure prescribed in § 15.40 (b).

(f) A request for approval of a complete item of equipment in this classification shall be supported by the following data:

(1) Complete references to the data pertaining to the basic structure previously deemed satisfactory by the Administrator.

(2) Data as prescribed in paragraph (e) (1) or (2) of this section, but pertaining only to the variable structure.

(3) Any additional data which may have been prescribed by the Administrator at the time of his examination of the basic structure.

PART 16—AIRCRAFT RADIO EQUIPMENT AIRWORTHINESS [1]

AUTHORITY: §§ 16.10 to 16.52 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply sec. 601, 52 Stat. 1007; 49 U. S. C. 551.

SOURCE: §§ 16.10 to 16.52 contained in Amendment 85, 5 F. R. 5144, except as noted following section affected.

GENERAL

§ 16.10 *Scope.* Aircraft radio equipment required by this chapter to be type certificated and installed in certificated aircraft is eligible for a type certificate upon meeting the requirements hereinafter prescribed.

§ 16.11 *Deviation.* New types, or new types of construction, of aircraft radio equipment which make the tests prescribed by the regulations in this part inapplicable may be subjected to such other tests as the Administrator may deem necessary to insure safe operation.

§ 16.12 *Waiver.* The tests prescribed herein may be waived whenever, in the opinion of the Administrator, a particular part of aircraft radio equipment is so designed or constructed that such tests are not necessary to insure airworthiness.

TECHNICAL DATA

§ 16.20 *General.* To be eligible for a type certificate for aircraft radio equipment, an applicant must submit the technical data described in §§ 16.21, 16.22, and 16.23.

§ 16.21 *Drawings.* One set of drawings in blueprint or equivalent form folded to approximately 9 by 12 inches containing the manufacturer's designation of the aircraft radio equipment and all details of design, construction, assembly, and materials used which are necessary for the reproduction of such aircraft radio equipment: *Provided,* That adequate photographs may be substituted for such drawings if such photographs are suitably marked to indicate the details required in this section.

§ 16.22 *Drawing list.* A drawing list setting forth in numerical order or by other suitable classification, the title and number or date of each drawing submitted under § 16.21.

§ 16.23 *Parts list.* A list specifying each component part of the aircraft radio equipment submitted to the Administrator for certification. The list shall indicate the physical or circuit location of each item and the type or model designation assigned to such item by the manufacturer.

CHARACTERISTICS

§ 16.30 *Design and tests.* To be eligible for type certification, aircraft radio equipment must be so designed and constructed that it will satisfactorily perform the function or functions for which it is intended to be used in aircraft under all flight conditions which may be met in regular service and must:

(a) Be free from hazard both in itself and in its method of operation;

(b) Be constructed of suitable and dependable materials;

(c) Satisfactorily pass a visual inspection of the construction, lay-out, and electrical arrangement of all components of the particular aircraft radio equipment and such electrical, humidity, temperature, pressure, vibration, drop, and other tests as the Administrator may prescribe.

[Amdt. 85, 5 F. R. 5144]

§ 16.30-1 *Cross-pointer indicators (CAA rules which apply to § 16.30).* (a) At the time the type I-101 Cross-Pointer Indicator was type certificated for use in conjunction with airborne ILS and VHF navigational equipment, it was recognized that the Indicator did not have incorporated in it certain warning features considered to be important in the interest of safety. However, as there was no indicator being manufactured at that time which did incorporate those features, the I-101 Indicator was type certificated for air carrier use subject to certain limitations.

(b) There is now in quantity production at least one type of ILS cross-pointer indicator which incorporates the so-called "flag alarm" indicator. There may be other equally satisfactory indicators under development.

(c) In view of the availability of the improved type indicator, it appears to be in the best interest of safety to discontinue use of the type I-101 Indicator as soon as practicable.

(d) Effective immediately, no cross-pointer indicator shall be type certificated for installation in air carrier aircraft unless a flag alarm or other satisfactory alarm system has been incorporated in the indicator. Effective December 31, 1948, the type certificate is canceled for the type I-101 Cross-Pointer Indicator, and after that date such Indicator shall not be used in air carrier operations.

[Supp. 1, 13 F. R. 4251. Correction noted at 14 F. R. 37]

INSPECTIONS AND TESTS

§ 16.40 *General.* The prescribed inspections and tests shall be conducted by the applicant under the supervision of representatives of the Administrator at a designated time and place and in such manner and under such conditions as they may deem necessary.

§ 16.41 *Facilities.* All engineering, technical, and physical facilities which may be necessary for the conduct of all of the prescribed inspections and tests shall be provided by the applicant.

§ 16.42 *Report.* The applicant shall submit in duplicate a written report of the results of the prescribed inspections and tests which shall be in such detail as the Administrator may require.

REGULATIONS

§ 16.50 *Identification.* Type certificated aircraft radio equipment shall be plainly and suitably marked with at least the following information:

(a) Name and address of manufacturer;

(b) Manufacturer's type or model designation;

(c) Weight to the nearest pound and fraction thereof;

(d) Serial number or date of manufacture;

(e) Type certificate number.

§ 16.51 *Modification.* No change shall be made in the approved specifications under which type certificated aircraft radio equipment is manufactured prior to the approval of such change by the Administrator.

§ 16.52 *List changes.* The holder of a type certificate for aircraft radio equipment shall keep all lists furnished the Administrator current by submitting revised lists containing all changes made subsequent to original certification.

PART 18—MAINTENANCE, REPAIR, AND ALTERATION OF CERTIFICATED AIRCRAFT AND OF AIRCRAFT ENGINES, PROPELLERS, AND INSTRUMENTS [1]

[1] Application for type certification of aircraft radio equipment should be made as prescribed in Part 2 of this subchapter. The provisions of §§ 2.2 and 2.3 of this subchapter providing for a production certificate and the rules for the operation under such certificate shall not be applicable to the case of type certification of aircraft radio equipment.

[1] Civil Aeronautics Manual 18, which may be secured from the Correspondence Section, Civil Aeronautics Administration, Washington 25, D. C., describes in detail the operations which the Administrator of Civil Aeronautics considers to be routine maintenance, minor and major repairs, and minor and major alterations. It sets forth in detail repair methods, techniques, and practices which the Administrator has found acceptable in the execution of repairs in accordance with the regulations in this part. It also describes forms, scope of technical data, and records prescribed by the Administrator in accordance with this part.

AUTHORITY: §§ 18.1 to 18.20 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 601, 605, 52 Stat. 1007, 1010; 49 U. S. C. 551, 554.

SOURCE: §§ 18.1 to 18.20 contained in Amendment 105, Civil Air Regulations, 6 F. R. 1811.

GENERAL

§ 18.1 *Definitions.* As used in this part: (a) "Aircraft engine" means an aircraft engine approved by the Administrator.

(b) "Propeller" means a propeller approved by the Administrator.

(c) "Instrument" means an instrument installed, for other than purely experimental purposes, in a certificated aircraft.

(d) "Manufacturer" means: (1) the holder of the type certificate, or approval by the Administrator, for an aircraft, aircraft engine, or propeller, or of the current rights, under a licensing arrangement, to the benefits of such type certificate or approval, or (2) the manufacturer of a part or accessory of a certificated aircraft, or (3) the manufacturer of an instrument which is installed in a certificated aircraft: *Provided*, That such manufacturer shall have in his employ a properly certificated mechanic in direct charge of maintenance, repair, or alteration operations.

MAINTENANCE, REPAIRS, AND ALTERATIONS

§ 18.5 *Routine maintenance.* Routine maintenance is defined as simple or minor preservation operations including but not limited to the adjustment of rigging and clearances, and the replacement of small standard parts not involving complex assembly operations.

§ 18.6 *Repairs.* A repair is any operation other than routine maintenance which is required to restore an aircraft, aircraft engine, propeller, or instrument to a condition for safe operation, including the mending or replacement of damaged or deteriorated parts.

(a) *Minor repairs.* Minor repairs are elementary repair operations executed in accordance with standard practices and not within the definition of major repairs.

(b) *Major repairs.* Major repairs are complex repair operations of vital importance to the airworthiness of an aircraft, including but not limited to:

(1) Straightening, splicing, welding and similar operations when the strength of important structural members might be appreciably affected thereby.

(2) Operations requiring complicated or unconventional techniques or equipment.

§ 18.7 *Alterations.* An alteration is any appreciable change in the design of an aircraft, aircraft engine, propeller, or instrument.

(a) *Minor alteration.* A minor alteration is:

(1) An alteration having no appreciable effect on the weight, balance, structural strength, power-plant operation, flight characteristics, or other characteristics affecting the airworthiness of an aircraft; or

(2) An alteration for which specific plans and instructions have been approved by the Administrator and which can be executed by means of elementary operations.

(b) *Major alterations.* Major alterations are all alterations not within the definition of minor alterations.

RULES AND PROCEDURES FOR MAINTENANCE, REPAIRS, AND ALTERATIONS

§ 18.10 *Agencies authorized to perform maintenance, repair, and alteration operations.* Maintenance, repair, and alteration operations shall be performed only by: (a) A certificated mechanic having the proper rating or a person working under the direct supervision of such mechanic; or (b) a certificated repair station having the proper rating; or (c) the manufacturer of the aircraft or part of the aircraft to be repaired: *Provided*, That all instrument repairs and alterations and propeller major repairs and major alterations shall be performed only by a certificated repair station having the proper rating or by the instrument or propeller manufacturer.

§ 18.11 *Provision for approval of major repairs and major alterations.* No aircraft, aircraft engine, or propeller which has undergone any major repair or major alteration shall be returned to service until examined, inspected, and approved by a duly authorized representative for the Administrator unless such repair or alteration has been executed in accordance with a manual or specification approved by the Administrator,[2] and performed by a certificated repair station of the proper rating or by the manufacturer.

§ 18.12 *Flight tests.* When an aircraft or aircraft engine or propeller thereof has undergone a maintenance, minor repair, or minor alteration operation which may have changed its flight characteristics appreciably or substantially affected its operation in flight, or has undergone a major repair or major alteration, such aircraft shall, prior to carrying passengers, be test flown by a pilot having at least 200 solo hours and holding at least a private pilot certificate and appropriate rating for the aircraft to be test flown.

RECORDING OF REPAIRS AND ALTERATIONS

§ 18.15 *Minor repair and minor alteration logbook entries.* An adequate description of every minor repair or minor alteration of an aircraft, aircraft engine, or propeller shall be entered in the appropriate logbook over the signature and certificate number of the mechanic directly in charge of or performing such repair or alteration and in case a manufacturer or a certificated repair station makes said repair or alteration the appropriate logbook shall also be signed by an authorized official of such agency. The installation of an instrument in an aircraft shall be recorded in the aircraft logbook by the agency making the installation.

§ 18.16 *Major repair and major alteration records.* A repair agency performing a major repair or major alteration on an aircraft, aircraft engine, or propeller, shall execute such Repair and Alterations Forms as may be prescribed and furnished by the Administrator, and shall deliver a duplicate copy of any such Form to the owner of the aircraft and make proper entries on the appropriate page of the Aircraft Operation Record.

§ 18.17 *Provisions for air carrier records.* Logbook and aircraft operation record entries required in this part may be replaced, in the case of repairs or alterations to scheduled air carrier aircraft, by a suitable system of recording repairs, alterations, and signatures of responsible personnel.

DESIGN, TECHNIQUES, AND MATERIALS

§ 18.20 *Design, techniques, and materials.* Repairs shall be so executed, and materials of such strength and quality shall be used that the condition of the repaired aircraft, aircraft engine, propeller, or instrument shall be at least equivalent to its original or a properly altered condition in regard to aerodynamic and mechanical function, structural strength, and resistance to vibration and deterioration, and all other qualities affecting airworthiness. Alterations shall be so designed and executed that the altered aircraft, aircraft engine, propeller, or instrument will comply with the airworthiness requirements in effect when the particular model of the aircraft or part of the aircraft was originally certificated and, in addition, with particular provisions of the current airworthiness requirements rendered necessary for safe operation by the alteration.

[2] Such manual or specification may, for example, be issued by the manufacturer, a certificated repair station, or by the Administrator. All such manuals or specifications issued by parties other than the Administrator must be approved by him.

PART 20—PILOT CERTIFICATES

AUTHORITY: §§ 20.1 to 20.82 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 601, 602, 52 Stat. 1007, 1008; 49 U. S. C. 551, 552; Pub. Law 872, 80th Cong.

SOURCE: §§ 20.1 to 20.82 contained in Amendment 20-0, Civil Air Regulations, 10 F. R. 5060, except as noted following sections affected.

CROSS REFERENCE: For regulations with respect to air-line transport pilot certificates and lighter-than-air pilot certificates, see Parts 21 and 22 of this subchapter.

STUDENT PILOT CERTIFICATE

§ 20.1 *Issuance.* A student pilot certificate will be issued by the Administrator or his authorized representative to an applicant who meets the applicable requirements.

[Amdt. 20-7, 12 F. R. 5008]

§ 20.2 *Age.* (a) Powered aircraft: 16 years.

(b) Gliders: 14 years.

If an applicant is less than 21 years of age at the time of making application, he shall submit with his application the written consent of either parent or legal or natural guardian.

§ 20.3 *Citizenship.* Applicant shall be a loyal citizen of the United States or of a friendly foreign government not under the domination of or associated with any government with which the United States is at war. (Wartime regulation to be revised when conditions permit.)

§ 20.4 *Education.* Applicant shall be able to read, write, speak, and understand the English language or an appropriate operation limitation will be placed on the student pilot certificate.

§ 20.5 *Physical standards*—(a) *Powered aircraft.* Applicant shall meet the physical standards of the third class prescribed in Part 29 of this subchapter.

(b) *Glider.* Applicant shall have no known physical defect which renders him incompetent to pilot a glider, and shall so certify.

§ 20.6 *Aeronautical knowledge.* None.

PILOT CERTIFICATE AND RATINGS

§ 20.10 *Issuance.* A pilot certificate shall be issued to an applicant who meets the minimum requirements prescribed herein. A private or commercial pilot rating, aircraft category, class, and type ratings, instrument rating, flight instructor rating, and any other necessary special ratings for which the pilot has been found qualified shall be issued in connection with a pilot certificate.

[Amdt. 20-2, 14 F. R. 2192]

§ 20.11 *Graduates of certificated flying schools.* A graduate of a certificated flying school will be deemed to have met the aeronautical experience requirements of this part, if he presents an appropriate certificate of graduation within 60 days after graduation date.

§ 20.12 *Limited pilot certificate.* A citizen of a foreign government who holds a currently effective pilot certificate or license issued by his government, upon submitting to the Administrator reliable evidence showing his pilot time and aeronautical experience may be issued a Limited Pilot Certificate appropriate to his pilot time and aeronautical experience shown. The holder of such certificate shall be familiar with the air traffic rules and shall not transport passengers or cargo where a charge is made for such transportation. The certificate shall contain such limitations as the Administrator finds necessary for safety, including but not limited to those which may be required by reason of the pilot's inability to speak and understand the English language.

[Amdt. 20-2, 11 F. R. 3244]

PRIVATE PILOT RATING

§ 20.20 *Age.* (a) Powered aircraft: 17 years.

(b) Glider: 14 years.

§ 20.21 *Citizenship.* Applicant shall be a loyal citizen of the United States or of a friendly foreign government not under the domination of or associated with any government with which the United States is at war. (Wartime regulations to be revised when conditions permit.)

§ 20.22 *Education.* Applicant shall be able to read, write, speak, and understand the English language or an appropriate operation limitation will be placed on the pilot certificate.

§ 20.23 *Physical standards*—(a) *Powered aircraft.* Applicant shall meet the physical standards of the third class prescribed in Part 29 of this subchapter.

(b) *Glider.* Applicant shall have no known physical defect which renders him incompetent to pilot a glider, and shall so certify.

§ 20.24 *Aeronautical knowledge.* Applicant for a powered aircraft or glider rating shall have passed the written examination prescribed in § 43.53 (a) of this subchapter within the preceding 24 calendar months.

[Amdt. 20-5, 12 F. R. 1417]

§ 20.25 *Aeronautical experience*—(a) *Powered aircraft.* An applicant for a pilot certificate with a private rating in powered aircraft shall meet the requirements of either subparagraphs (1) or (2), and (3) of this paragraph. If the applicant meets the requirements of subparagraph (2) but not subparagraph (1) of this paragraph, his certificate shall be appropriately endorsed by the Administrator.

(1) In spinnable aircraft he shall have at least 30 hours of solo flight time and at least 10 hours of dual instruction time given by a rated flight instructor.

(i) At least 2 hours of the dual instruction time shall have been after solo.

(ii) The dual instruction shall include instruction in the prevention of and recovery from power-on and power-off stalls entered from all normally anticipated flight attitudes.

(iii) If the applicant is the holder of a private or commercial pilot certificate with a glider rating, he may receive credit for not more than 15 hours of the required solo flight time for the flight time had in gliders; or

(2) In nonspinnable aircraft he shall have at least 20 hours of solo flight time and at least 7 hours of dual instruction time given by a rated flight instructor.

(i) At least 2 hours of the dual instruction time shall have been after solo.

(ii) If the applicant is the holder of a private or commercial pilot certificate with glider rating, he may receive credit for not more than 10 hours of the required solo flight time for the flight time had in gliders; and

(3) In either spinnable or nonspinnable aircraft he shall have at least 3 hours of solo cross-country flight time which shall include at least one solo flight to a point not less than 50 miles distant from the point of departure with at least 2 full-stop landings at different points along the course.

(b) *Glider.* Applicant for a glider rating shall have had at least 100 glider flights or 10 hours of glider flight time including at least 50 glider flights. At least 25 flights must have included a 360° turn.

[Amdt. 20-8, 12 F. R. 6852, and Amdt. 20-3, 14 F. R. 3326]

NOTE: § 20.25 (a) was amended by Amdt. 20-3 effective Aug. 15, 1949.

§ 20.26 *Aeronautical skill.* Applicant shall competently perform the following maneuvers:

(a) *Powered aircraft.* (1) A series of 3 landings from an altitude not to exceed 1,000 feet with engine throttled and a 180° change in direction, the aircraft touching the ground in normal landing attitude beyond and within 300 feet of a designated line or point. At least one landing must be accomplished from a forward slip;

(2) 3 moderately banked around-pylon figure eights, variation in altitude not to exceed 200 feet;

(3) A 720° power turn in each direction in a banked attitude of more than 45°, variation in altitude not to exceed 200 feet.

(4) Climbing and gliding turns at minimum controllable speeds;

(5) Recovery from power-on and power-off stalls entered from all normally anticipated flight attitudes;

(6) [Revoked.]

Any of the maneuvers required by this section may be modified or eliminated if such action is appropriate to the characteristics of the aircraft used in the test and appropriate operation limitations are entered on the rating record.

(b) *Glider.* (1) One flight with a 180° turn and down-wind landing;

(2) Two flights with a 360° turn to the right and left, respectively, landing each time at a point beyond and within 200 feet of a designated line or point;

(3) Two flights with right and left turns in each flight.

(c) *Aircraft limitation.* When the applicant's medical certificate shows a structural defect or limitation, such additional maneuvers and tests as may be necessary to demonstrate the competency of the applicant to pilot aircraft safely shall be required. A pilot certificate issued under these circumstances may be limited to the operation of a particular aircraft or type of aircraft and to the type of operation.

[Amdt. 20-0, 10 F. R. 5060, as amended by Amdt. 20-2, 14 F. R. 2192, and Amdt. 20-3, 14 F. R. 3326]

NOTE: § 20.26 (a) (5) was amended and § 20.26 (a) (6) was revoked by Amdt. 20-3, effective Aug. 15, 1949.

COMMERCIAL PILOT RATING

§ 20.30 *Age.* 18 years.

§ 20.31 *Citizenship.* Applicant shall be a citizen of the United States or of a foreign government which grants or has undertaken to grant reciprocal commercial pilot privileges to citizens of the United States on equal terms and conditions with citizens of such foreign government.

[Amdt. 20-10, 13 F. R. 4313.]

§ 20.32 *Education.* Applicant shall be able to read, write, speak, and understand the English language.

§ 20.33 *Physical standards*—(a) *Powered aircraft.* Applicant for a powered aircraft rating shall meet the physical standards of the second class prescribed in Part 29 of this subchapter.

(b) *Glider.* Applicant shall have no known physical defect which renders him incompetent to pilot a glider, and shall so certify.

§ 20.34 *Aeronautical knowledge*—(a) *Powered aircraft.* Applicant shall pass a written examination covering such of the provisions of Parts 43 and 60 of this subchapter as are pertinent; meteorology as applied to the recognition of weather conditions while flying, the analyzing of weather maps and sequence reports furnished by the United States Weather Bureau; practical air navigation problems including the use of maps, navigation by terrain and dead reckoning, and the use of navigational instruments and aids; the theory and practice of flight; the maintenance of aircraft and the maintenance and use of aircraft powerplants in common use.

(b) *Glider.* Applicant shall pass a written examination on such of the provisions of Parts 43 and 60 of this subchapter as are pertinent or hold a powered aircraft rating.

§ 20.35 *Aeronautical experience*—(a) *Powered aircraft.* An applicant for a commercial pilot rating shall have a total of at least 200 hours of flight time credited in accordance with Part 43 of this chapter. This total flight time shall include at least 100 hours of flight time as pilot in command, of which 5 hours shall have been flown within 60 days immediately preceding the date of application; 20 hours of cross-country flight time as pilot in command which shall include at least one flight of not less than 350 miles in the course of which 3 full-stop landings are made at different points; and 10 hours of night flight time of which 5 hours may be dual instruction time, and which shall include not less than 10 take-offs and 10 landings as pilot in command and as sole manipulator of the controls. The required 100 hours of pilot in command flight time may include the cross-country and night flight time required to be flown as pilot in command.

(1) An applicant who does not meet the above-mentioned night flight time requirements but does meet the other requirements of this section may be issued a pilot certificate with a commercial rating, and in that event the Administrator shall appropriately endorse such certificate to show that the holder thereof does not meet the night flight time requirement.[1] At such time as the holder of a certificate so endorsed submits reliable documentary evidence to the Administrator that he has met such night flight time requirement, he shall be reissued a certificate without such endorsement.

(2) Not more than 25% of the flight time flown as pilot in command may be had in glider aircraft provided the applicant holds a pilot certificate with a private or commercial glider rating.

(b) *Glider.* Applicant shall have had at least 250 glider flights, or 25 hours of glider flight time including at least 125 glider flights. At least 5 flights must have been made within 60 days preceding the date of application. Applicant also shall have had at least one hour of flight instruction in recovery from stalls and spins. An applicant who is the holder of a private or commercial rating for a powered aircraft and who has had not less than 100 glider flights, or 10 hours of glider flight time including at least 50 glider flights, will be deemed to have met the requirements of this section.

[Amdt. 20-8, 12 F. R. 6852, and Amdt. 20-4, 14 F. R. 3521]

§ 20.36 *Aeronautical skill.* Applicant shall competently perform the following maneuvers:

(a) *Powered aircraft.* (1) A series of 3 landings from an altitude not to exceed 1,000 feet with engine throttled and a 180° change in direction, the aircraft touching the ground in normal landing attitude beyond and within 200 feet of a designated line or point. At least one landing shall be accomplished from a forward slip;

(2) A spiral in each direction of not less than 3 full turns in a banked attitude of not less than 60°, with engine throttled;

(3) 3 shallow on-pylon figure eights, 3 steep on-pylon figure eights, and one 720° power turn in each direction in a banked attitude of at least 60°. During each of these maneuvers the total variation in altitude shall not exceed 100 feet;

(4) [Revoked.]

(5) Straight climbs, climbing turns, slips, maneuvers at minimum controllable speeds, and emergency maneuvers such as simulated forced landings and recovery from power-on and power-off stalls entered from all normally anticipated flight attitudes.

(b) *Glider.* (1) One flight with a 180° turn and down-wind landing;

(2) Two flights with a 360° turn to right and left, respectively, landing each time beyond and within 100 feet of a designated line or point;

(3) Two flights with right and left turns in each flight.

[Amdt. 20-0, 10 F. R. 5060, as amended by Amdt. 20-3, 14 F. R. 3326]

NOTE: § 20.36 (a) (4) was revoked and 20.36 (a) (5) was amended by Amdt. 20-3, effective Aug. 15, 1949.

AIRCRAFT, FLIGHT INSTRUCTOR, AND INSTRUMENT RATINGS

§ 20.40 *Aircraft rating competence.* (a) An applicant for any additional aircraft rating subsequent to the original issuance of a pilot certificate shall demonstrate competency in aircraft of the category and class and, if the aircraft has a maximum certificated take-off weight of over 12,500 lbs., of the type for which the rating is sought.

[1] Paragraph 2.4.1.3 (c) of Annex 1 (Personnel Licensing Standards) to the Convention on International Civil Aviation provides that an applicant for a commercial pilot certificate shall have 10 hours of night flight time as set forth in the above text. An individual holding a pilot certificate with a commercial rating who does not meet such requirement may not participate in international flight as a commercial pilot unless he receives permission from the State or States whose territory is entered. Further, pursuant to the provisions of Article 39 of the Convention on International Civil Aviation he shall have endorsed on his certificate the particulars in which he does not meet the International Standards. However, such endorsement on a commercial rating issued by the Administrator does not prohibit the holder thereof from exercising the privileges of a commercial pilot rating while flying in the United States.

(b) A pilot limited by his rating to nonspinnable aircraft, when applying for removal of this restriction, shall have had at least 30 solo hours, and shall have had at least 3 hours of certified dual instruction in spinnable aircraft which shall include instruction in recovery from power-on and power-off stalls entered from all normally anticipated flight attitudes.

(c) A pilot limited by his rating to gliders, when applying for a pilot rating in powered aircraft, shall meet the aeronautical knowledge, experience, and skill requirements appropriate to the pilot rating sought.

[Amdt. 20-3, effective Aug. 15, 1949, 14 F. R. 3327]

§ 20.41 *Flight instructor rating for powered aircraft*—(a) *Age.* 18 years.

(b) *Knowledge.* Applicant shall pass a theoretical and practical examination on his competency to instruct students in flight.

(c) *Experience.* Applicant shall be a commercial pilot or a private pilot who meets the requirements of § 20.35 (a).

(d) *Skill.* Applicant shall demonstrate his ability to perform with precision and to teach such flight maneuvers as are necessary and appropriate for instruction in the safe piloting of aircraft.

§ 20.42 *Instrument rating*—(a) *Knowledge.* Applicant shall pass a written examination demonstrating his familiarity with the use of such instruments and other navigational aids, both in the aircraft and on the ground, as are necessary for the navigation of aircraft by instruments, with instrument flight rules, and with flight planning in relation to air traffic control services and aircraft performance. An applicant who is a private pilot shall, in addition, meet the knowledge requirements of § 20.34 (a), except those pertinent to the maintenance of aircraft and aircraft engines.

(b) *Experience.* An applicant shall hold a private or commercial pilot rating and shall have at least:

(1) 150 hours of flight time as pilot in command, of which not less than 50 hours shall be cross-country flight time; and

(2) 40 hours of instrument time under actual or simulated instrument flight conditions, of which not less than 20 hours shall have been in actual flight.

(c) *Aeronautical skill.* Applicant shall competently perform the following maneuvers solely by reference to instruments:

(1) Straight and level flight,

(2) Moderately banked 180° and 360° turns in both directions,

(3) Straight and level flight at minimum safe speeds, minimum glides, maximum climbs, and approaches to stalled attitudes of flight,

(4) Climbing turns,

(5) Stalls, skids, slips, spirals, banks in excess of 45°, and recovery from unusual positions,

(6) A demonstration of estimating arrival time, taking into account speed, wind, and drift.

(d) *Radio skill.* Applicant shall demonstrate his competence while flying solely by reference to instruments with respect to the following items:

(1) Tuning radio,

(2) Orientation,

(3) Operation along a radio range leg,

(4) Locating cone of silence,

(5) Let-down using approved instrument approach procedure for the particular airport.

(e) *Modified tests.* Any of the maneuvers or procedures required in paragraphs (c) and (d) of this section may be modified or eliminated if such action is appropriate to the characteristics of the aircraft or equipment used in the test and appropriate operation limitations are noted.

[Amdt. 20-0, 10 F. R. 5060, as amended by Amdt. 20-2, 14 F. R. 2192]

CERTIFICATION RULES

§ 20.50 *Application.* Application for a student pilot certificate, pilot certificate, or any rating shall be made on a form furnished by the Administrator.

§ 20.51 *Duration.* (a) A student pilot certificate shall expire 24 calendar months after the month of issuance.

(b) A pilot certificate with a private or commercial rating shall remain in effect unless it is suspended, or revoked, or a general termination date for such certificate is fixed by the Board.

[Amdt. 20-7, 12 F. R. 5008]

§ 20.52 *Temporary certificates.* The Administrator or his authorized representative may issue a temporary student pilot certificate or a temporary pilot certificate with a private or commercial rating for a period of not to exceed 90 days, subject to the terms and conditions specified therein by the Administrator.

[Amdt. 20-7, 12 F. R. 5008]

§ 20.53 *Surrender.* Any pilot shall, upon request, deliver his certificate or rating to the Administrator, if it has been suspended or revoked.

§ 20.54 *Exchange of certificates.* (a) A private or commercial pilot certificate which was effective on or after January 1, 1942, and which was issued prior to July 1, 1945, will expire on July 1, 1947. Such certificate may be exchanged at any time prior to July 1, 1947, for a pilot certificate and the appropriate ratings provided for in this part.

(b) *Reissuance.* Any person who on June 30, 1947, held a valid private or commercial certificate and who failed to exchange such certificate in accordance with paragraph (a) of this section, may, notwithstanding such failure and without other showing, obtain a pilot certificate with appropriate ratings upon application to the Administrator.

[Amdt. 20-4, 12 F. R. 40, as amended by Amdt. 20-6, 12 F. R. 5007]

§ 20.55 *Military competence.* Certificates granted on the basis of military competence shall be issued under the conditions specified in this section.

(a) *Private pilot rating.* An applicant for a pilot certificate with a private pilot rating on the basis of military competence shall be deemed to have met the aeronautical knowledge, experience, and skill requirements of this subchapter for the issuance of such certificate, if he passes a written examination on Parts 43 and 60 of this subchapter and presents reliable documentary evidence showing:

(1) That he is a member of the armed forces of the United States or a civilian employee of the ferry or transport services of such forces, and is on solo flying status as a rated pilot or the equivalent, or

(2) That he has been honorably discharged or released from such forces and has had at least 10 hours of solo flying in military aircraft within the preceding 12 calendar months.

(b) *Commercial pilot rating.* An applicant for a pilot certificate with a commercial pilot rating on the basis of military competence shall be deemed to have met the aeronautical knowledge, experience, and skill requirements of this subchapter for the issuance of such certificate, if he passes a written examination on Parts 43 and 60 of this subchapter and presents reliable documentary evidence showing:

(1) That he is a member of the armed forces of the United States or a civilian employee of the ferry or transport services of such forces and that he has been on active duty on solo flying status as a rated pilot or the equivalent for a period of at least 6 consecutive months immediately preceding application, or

(2) That he has been honorably discharged or released from such forces and had been on active duty of the type specified in subparagraph (1) of this paragraph for a period of at least 6 consecutive months within 18 months immediately preceding application.

(c) *Aircraft category, class, and type ratings based on military competence.* An applicant for a particular rating, who holds a pilot certificate issued on the basis of military competency or otherwise, shall be issued appropriate aircraft category, class, and type ratings upon the presentation of reliable documentary evidence that he has within the preceding 12 months had at least 10 hours of flight time in military aircraft during which he was first pilot or the sole manipulator of the controls of an aircraft of the category, class, and type for which a rating is sought.

(d) *Instrument rating.* An instrument rating will be issued to an applicant who holds a currently effective military instrument rating if the requirements for the issuance of such a rating and the privileges authorized by it are not less than those of this subchapter with respect to such rating.

[Amdt. 20-9, 13 F. R. 2790 as amended by Amdt. 20-2, 14 F. R. 2192]

EXAMINATIONS AND TESTS

§ 20.60 *General.* The prescribed examinations and tests shall be given by a person designated by the Administrator.

§ 20.61 *Physical examination.* Prior to taking a flight test for a rating, an applicant shall have met the appropriate physical requirements within the time limitations hereinafter prescribed:

(a) *Private rating.* Within the preceding 24 months.

(b) *Commercial rating.* Within the preceding 12 months.

[Amdt. 20-1, 14 F. R. 109]

§ 20.62 *Aircraft used in flight tests*—(a) *Powered aircraft.* Applicant shall furnish a certificated aircraft which must be equipped with complete dual controls and accommodate the applicant and examiner and parachutes for both. In addition, aircraft used for instrument flight tests shall be equipped as specified in § 43.30 (c).

(b) *Glider.* Applicant shall furnish a certificated glider.

§ 20.63 *Time and place.* All examinations and tests will be held at such times and places as the Administrator may designate.

§ 20.64 *Reapplication after failure.* Applicants who have failed in any examination will be subject to the following rules in making application for reexamination:

(a) An applicant for a pilot certificate with a powered aircraft rating or for an additional rating who fails to pass any prescribed theoretical examination may reapply after the expiration of 30 days from the date of such failure or after he has received not less than 5 hours of instruction from a certificated ground instructor in each subject failed.

(b) An applicant who has failed to pass any prescribed practical examination or test on powered aircraft may reapply only after an appropriately rated flight instructor has checked his competency and certified in the applicant's logbook that he considers such applicant qualified for the certificate or rating sought, or after the expiration of 30 days from the date of such failure.

(c) An applicant for a glider rating who has failed to pass any prescribed theoretical examination may reapply at any time after the expiration of 30 days or after he has received not less than 5 hours of instruction on each subject failed from a certificated ground instructor.

(d) An applicant for a glider rating who has failed to pass any prescribed practical examination or test may reapply only after he has made at least 20 additional gliding flights.

DEFINITIONS

§ 20.70 *Definitions.* As used in this part the words listed below shall be defined as follows:

[Amdt. 20-2, 14 F. R. 2193]

§ 20.71 *Category.* Category shall indicate a classification of aircraft such as airplane, helicopter, glider, etc.

[Amdt. 20-2, 14 F. R. 2193]

§ 20.72 *Class.* Class shall indicate a difference in basic design of aircraft within a category, such as single-engine land, multi-engine sea, etc.

[Amdt. 20-2, 14 F. R. 2193]

§ 20.73 *Copilot.* Copilot shall mean a pilot serving in any piloting capacity other than as pilot in command on aircraft requiring two pilots for normal operations, but excluding a pilot who is on board the aircraft for the sole purpose of receiving flight instruction.

[Amdt. 20-2, 14 F. R. 2193]

§ 20.74 *Dual instruction time.* Dual instruction time shall mean that portion of the flight time during which a person is receiving flight instruction from a rated flight instructor on board the aircraft.

[Amdt. 20-2, 14 F. R. 2193]

§ 20.75 *Flight instructor.* Flight instructor means a pilot who is qualified to instruct other pilots and who has received a flight instructor rating.

[Amdt. 20-2, 14 F. R. 2193]

§ 20.76 *Flight time.* Flight time shall mean the total time from the moment the aircraft first moves under its own power for the purpose of flight until the moment it comes to rest at the end of the flight.[2]

[Amdt. 20-2, 14 F. R. 2193]

§ 20.77 *Maximum certificated take-off weight.* Maximum certificated take-off weight shall mean the maximum take-off weight authorized by the terms of the aircraft airworthiness certificate.

[Amdt. 20-2, 14 F. R. 2193]

§ 20.78 *Night.* Night is the time between the ending of evening twilight and the beginning of morning twilight as published in the Nautical Almanac converted to local time for the locality concerned.[3]

[Amdt. 20-2, 14 F. R. 2193]

§ 20.79 *Pilot.* A pilot is an individual who manipulates the controls of an aircraft during the time defined as flight time.

[Amdt. 20-2, 14 F. R. 2193]

§ 20.80 *Pilot in command.* Pilot in command shall mean the pilot responsible for the operation and safety of the aircraft during the time defined as flight time.

[Amdt. 20-2, 14 F. R. 2193]

§ 20.81 *Solo flight time.* Solo flight time shall mean the flight time during which a pilot is the sole occupant of an aircraft.

[Amdt. 20-2, 14 F. R. 2193]

§ 20.82 *Type.* Type shall mean all aircraft of the same basic design including all modifications thereto except those modifications which result in a change in handling or flight characteristics.

[Amdt. 20-2, 14 F. R. 2193]

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[2] For example, a pilot taxies to the warm-up apron and holds there for several minutes before taking off to permit the engine to warm up. Such taxi and warm-up time is not considered flight time. Flight time begins when the aircraft leaves the warm-up apron and ends when the pilot returns to the parking apron and turns the switches off.

[3] The Nautical Almanac containing the ending of evening twilight and the beginning of morning twilight tables may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Information is also available concerning such tables in the offices of the Civil Aeronautics Administration or the United States Weather Bureau.

PART 21—AIR-LINE TRANSPORT PILOT RATING

AUTHORITY: §§ 21.1 to 21.58 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 601, 602, 52 Stat. 1007, 1008; 49 U. S. C. 551, 552.

SOURCE: §§ 21.1 to 21.58 contained in Civil Air Regulations, May 31, 1938, amended by Amendment 75, 5 F. R. 3946, except as noted following sections affected.

§ 21.1 *Provision for issuance.* Pursuant to the provisions of the Civil Aeronautics Act of 1938, as amended, empowering the Administrator of Civil Aeronautics to issue airman certificates specifying the capacity in which the holders thereof are authorized to serve as airmen in connection with aircraft, and requiring the Civil Aeronautics Board to prescribe such reasonable rules and regulations governing practices, methods, and procedures as the Board may find necessary to provide adequately for safety in air commerce, air-line transport pilots will be rated as to competence in accordance with the provisions of the following regulations.

[Reg. 601-A-1, 3 F. R. 2053, as amended by Amdt. 75, 5 F. R. 3946]

MINIMUM REQUIREMENTS

§ 21.9 *Eligibility.* To be eligible for an airline transport pilot competency rating, an applicant shall comply with the minimum requirements set forth in §§ 21.10–21.18.

§ 21.10 *Age.* Applicant shall be at least 23 years of age.

§ 21.11 *Character.* Applicant shall be of good moral character.

§ 21.12 *Citizenship.* Applicant shall be a citizen of the United States or of a foreign government which grants or has undertaken to grant reciprocal air-line transport pilot privileges to citizens of the United States on equal terms and conditions with citizens of such foreign government.

[Admt. 21-5, 13 F. R. 4313]

§ 21.13 *Education.* (a) Applicant shall be able to read, write, and understand the English language, and shall be able to speak the English language without accent or impediment of speech which would interfere with two-way radio conversation; and

(b) Shall be a high school graduate or what is deemed by the Administrator to be its equivalent from the applicant's showing of general experience and aeronautical experience, knowledge, and skill.

§ 21.14 *Physical condition.* Applicant shall meet the physical standards of the First Class prescribed in Part 29 of this subchapter.

[Amdt. 21-6 7 F. R. 3923]

§ 21.15 *Aeronautical knowledge.* Applicant shall be familiar with and shall accomplish a satisfactory written examination on:

(a) The provisions of Parts 1, 21, 27, 40, 60, 61, and 98 of this subchapter, together with such parts of the provisions of Part 4a of this subchapter as are pertinent to the operations of air carrier aircraft.

(b) The fundamentals of air navigation and the use of formulas and of instruments and other navigational aids, both in aircraft and on the ground, which are deemed necessary for the navigation of aircraft by instruments.

(c) The general system of weather collection and dissemination.

(d) Weather map, weather forecast, and weather sequence abbreviations, symbols, and nomenclature.

(e) Elementary meteorology, including modern knowledge of the cyclons as associated with fronts.

(f) Cloud forms.

(g) Department of Agriculture Weather Bureau Circular N, Instructions for Airway Meteorological Service, and all amendments thereto.

(h) Weather conditions, including icing conditions and upper-air winds, affecting aeronautical activities.

(i) Air navigation facilities in use on the civil airways, including rotating beacons, course lights, radio ranges, and radio marker beacons.

(j) Data obtained from airplane weather observations and meteorological data reported from observations made by pilots engaged in air carrier flights.

(k) The influence of terrain upon meteorological conditions and developments, and the relation thereof to air carrier flight operations.

(l) Radio communication procedure as applied to aircraft operation.

(m) The basic principles of loading and weight distribution and its effect on flight characteristics.

[CAR, May 31, 1938, as amended by Amdt. 81, 5 F. R. 4530, and Amdt. 21-6, 14 F. R. 2194]

§ 21.16 *Aeronautical experience.* An applicant for an airline transport pilot rating shall hold a valid commercial pilot rating, or equivalent as determined by the Administrator, and shall have had at least 1,200 hours of flight time as pilot within the last 8 years, of which

(a) 5 hours shall have been had within 60 days immediately preceding the date of application;

(b) 500 hours shall have been cross-country flight time;

(c) 100 hours shall have been night flight time;

(d) 75 hours shall have been instrument time under actual or simulated instrument conditions of which not less than 50 hours shall have been in actual flight; and

(e) 250 hours of the preceding requirements shall have been as pilot in command, of which 100 hours shall have been cross-country flight time and at least 25 hours shall have been night flight time.

[Amdt. 21-6, 14 F. R. 2194]

§ 21.17 *Aeronautical skill.* (a) Applicant shall demonstrate satisfactorily his ability to pilot aircraft in normal take-offs, turns, landings, and the following maneuvers (the maneuvers in subparagraphs (6) and (7) of this paragraph shall be performed in an aircraft satisfactory to the examining inspector of the Administrator):

(1) From 3,500 feet, with engine throttled, a 360° turn and a landing in normal landing attitude.

(2) From 2,500 feet, with engine throttled, a 180° turn and a landing in normal landing attitude.

(3) A series of three shallow and three steep figure **8** turns and one 720° steep power turn in each direction. During these maneuvers, the pilot shall not gain or lose more than 200 feet of altitude.

(4) A spiral in one direction from 3,500 feet, or higher, with engine throttled, and a landing in normal landing attitude.

(5) Subparagraphs (1) through (4) of this paragraph shall be applicable when the flight tests are conducted in aircraft of a gross weight in excess of 10,000 pounds; otherwise the pilot shall be required to demonstrate his aeronautical skill in accordance with § 20.26 of this subchapter.

(6) Emergency maneuvers such as simulated forced landings, spirals, side slips and climbing turns, and recovery from stalls, maneuvers in multiengine equipment with authorized load with one engine inoperative, if rating is sought on such equipment, and such other maneuvers as the examining inspector of the Administrator may deem necessary to demonstrate the competence of the applicant.

(7) A right-hand and a left-hand spin, each of at least two full turns, with not to exceed 10 degrees error.

NOTE: The requirements of subparagraphs (1)–(7) of this paragraph and of § 21.18 (b) may be met by the holding of a valid commercial rating.

(b) Applicant shall accomplish satisfactorily a flight test, solely by instruments, with respect to the following:

(1) Straight level flight for a given period of time.

(2) Moderate banks during 180° and 360° turns in both directions.

(3) Minimum glides and maximum climbs, and approaches to stalled attitudes of flight.

(4) Climbing turns.

(5) Stalls, skids, slips and spirals, and banks in excess of 45°, and recovery from the same.

NOTE: The requirements of subparagraphs (1)–(5) of this paragraph may be met by the holding of a valid instrument rating.

(6) Such other maneuvers as the examining inspector deems necessary.

(7) A practical demonstration, while in flight or under simulated conditions, of estimating arrival time, taking into account speed, wind, and drift.

[CAR, May 31, 1938, as amended by Amdt 101, 6 F. R. 1159, Amdt. 115, 6 F. R. 2871 and Amdt. 21-6, 14 F. R. 2194]

§ 21.18 *Radio skill.* (a) An applicant shall demonstrate his ability to interpret International Morse Code signals, and shall accomplish a satisfactory flight test in a hooded cockpit with respect to the following:

(1) Tuning radio.

(2) Orientation. Effective January 1, 1939, such orientation shall include the use of the radio direction finder with sufficient tests to determine the ability of the pilot to:

(i) Home on a radio station.

(ii) Determine whether the aircraft is heading toward or away from the station.

(iii) Obtain accurate fixes by the use of radio compass.

(3) Following radio range.

(4) Locating cone of silence.

(5) Letting-down-through on the range by the approved instrument approach procedure for the particular airport used in connection with the test.

(6) Such other maneuvers as the examining inspector deems necessary.

(b) Such maneuvers as are necessary to demonstrate competence to satisfactorily pilot an aircraft from either control seat. None of the maneuvers provided for in §§ 21.17 and 21.18 shall be disregarded, but any such maneuver may be modified by the examining inspector of the Administrator to such extent as may be necessary for reasonable and safe operation of the aircraft used in the particular maneuver. Such inspector will report any such modification to the Administrator in writing.

[CAR, May 31, 1938, as amended by Amdt. 21-6, 14 F. R. 2194]

AIR-LINE TRANSPORT PILOT COMPETENCY CERTIFICATE

§ 21.20 *Existing aircraft ratings.* Every pilot having an airline transport pilot rating with appropriate aircraft category and class, and horsepower ratings, issued by the Administrator prior to May 1, 1949, may continue to operate aircraft in accordance with the limitations of such rating until the expiration, suspension, revocation, or surrender of the rating: *Provided*, That after May 1, 1953, each such pilot shall comply with § 21.35 (b).[1]

(a) *Aircraft rating.* The aircraft which the applicant is deemed competent to pilot shall be prescribed in his certificate by category and class, and type if the aircraft has a maximum certificated take-off weight of 12,500 lbs. or more and, in the case of unconventional airplanes, such description as is appropriate to define clearly the competence of the applicant. Competence to pilot aircraft shall be demonstrated in aircraft of the category and class and, if appropriate, the type for which the rating is sought.

[Amdt. 21-6, 14 F. R. 2194]

§ 21.21 *Application.* Application for an air-line transport pilot certificate shall be made to the Administrator upon a form supplied for the purpose.

(a) *Application to amend.* When any change in an air-line transport pilot competency rating is desired, the applicant shall file a written request therefor with the Administrator upon a form supplied for the purpose.

(b) *Revocation.* No person whose air-line transport pilot certificate has been revoked shall apply for or be issued a pilot certificate of any grade or rating for a period of 1 year after the revocation, except as the order of revocation may otherwise provide.

[CAR, May 31, 1938, as amended by Reg. 601-A-1, 3 F. R. 2052, Amdt. 19, 4 F. R. 3391, and Amdt. 87, 5 F. R. 5256]

§ 21.22 *Issuance.* Upon approval of an application duly made, proofs submitted and examinations and tests satisfactorily completed, an air-line transport pilot certificate will be issued in an appropriate form.

(a) *Temporary certificate.* Following application made for an air-line transport pilot certificate, but prior to approval thereof and issuance of the certificate, a temporary air-line transport pilot certificate may be issued by the examining inspector of the Administrator.

(b) *Special ratings.* A special rating, except an instrument rating, will be issued to and renewed for the holder of a valid air-line transport pilot certificate pursuant to the provisions of §§ 20.40–20.42, and upon the same terms as such rating is issued to and renewed for the holder of a valid commercial pilot certificate.

[1] Annex 1 to the Convention on International Civil Aviation (Personnel Licensing Standards) requires a pilot to have a type rating for all aircraft of a maximum certificated take-off weight of over 12,500 pounds. However, by the terms of the Convention, a holder of a pilot certificate issued prior to May 1, 1949, may, until May 1, 1953, exercise all of the privileges of such certificate both in the United States and internationally without compliance with such international standard.

(c) *Instruction in air transportation service.* Any person holding a valid airline transport pilot rating shall be considered competent to instruct other pilots in air transportation service in aircraft of a category, class, and type specified in the airline transport pilot rating of the instructing pilot. No pilot shall give more than 8 hours of such instruction in any one day nor more than 36 hours in any 7-day period. Such instruction shall be given only in aircraft equipped with fully functioning dual controls.

[CAR, May 31, 1938, as amended by Reg. 601-A-1, 3 F. R. 2052, Amdt. 115, 6 F. R. 2872, Amdt. 21-9, 7 F. R. 6632, and Amdt. 21-6, 14 F. R. 2194]

§ 21.23 *Display.* An air-line transport pilot certificate shall be kept in the personal possession of the pilot at all times when piloting aircraft, and shall be presented for inspection upon the demand of any passenger, or of any authorized official or employee of the Administrator or Board or any State or municipal official charged with the duty of enforcing local laws or regulations involving Federal compliance, or upon the reasonable request of any other person.

[CAR, May 31, 1938, as amended by Reg. 601-A-1, 3 F. R. 2052, Amdt. 75, 5 F. R. 3946]

§ 21.24 *Duration.* An air-line transport pilot certificate shall be of 60 days' duration and, unless the holder thereof is otherwise notified by the Administrator within such period, it shall continue in effect thereafter, until otherwise specified by the Board, unless suspended or revoked.

[Amdt. 21-7, 7 F. R. 5037]

§ 21.25 *Nontransferability.* An air-line pilot certificate is not transferable.

§ 21.26 *Operation during physical deficiency.* A certificated air-line transport pilot shall not operate any aircraft during the period of any known physical deficiency or increase in physical deficiency which would render him during that period unable to meet the physical requirements with which he complied in order to secure his certificate.

[Amdt. 75, 5 F. R. 3946]

§ 21.27 *Surrender.* Upon the suspension, revocation, or expiration of an air-line transport pilot certificate, the holder of such certificate shall, upon request, surrender such certificate to any officer or employee of the Administrator.

[Amdt. 75, 5 F. R. 3946]

§ 21.28 *Reexamination.* (a) An applicant who has failed any prescribed theoretical examination may apply for reexamination at any time after the expiration of 30 days from the date of such failure or after he has received not less than 5 hours instruction in each subject failed from a person employed by an air-line to instruct in such subject or from whichever one of the following persons is appropriate:

(1) A certificated air-line transport pilot;

(2) A certificated ground instructor rated for the subject;

(3) A person qualified to instruct in the theory of instrument flight.

(b) An applicant who has failed to pass any prescribed practical examination or test may apply for reexamination only after (1) he has logged at least 5 additional hours of flying solely by instruments and at least 5 additional hours of dual flight instruction with a certificated flight instructor or a certificated air-line transport pilot, or (2) he has acquired such part of the above practice or instruction as may, in the opinion of the Administrator, warrant reexamination. Upon meeting the requirements of this paragraph an applicant for reexamination shall be deemed to meet the 5 hours solo flight time requirements set forth in § 21.16 (b).

(c) Applicant shall present a statement from the instructor indicating that he has given the required instruction and that he deems the applicant qualified to pass the flight test or that part of the theoretical examination in which such instruction was given, whichever is appropriate.

[Amdt. 21-10, 7 F. R. 8414]

EXAMINATIONS AND TESTS

§ 21.30 *General.* The examinations and tests prescribed in the regulations of this part (both for an air-line transport pilot certificate and for the ratings issued with respect thereto) will be conducted by an authorized officer or employee of the Administrator or by a properly qualified person designated for the purpose by the Administrator. During the flight tests the air carrier may have a check pilot on board.

[CAR, May 31, 1938, as amended by Reg. 601-A-1, 3 F. R. 2055]

§ 21.31 *Physical examination.* In connection with the original issuance of any air-line transport pilot certificate the physical examination prescribed shall be accomplished by a medical examiner of the Administrator of Civil Aeronautics, duly authorized to so examine such pilots, before any practical or theoretical test or other examination will be given, and shall be completed within the 6 months preceding the date of filing application for such pilot certificate.

[CAR, May 31, 1938, as amended by Reg. 601-A-1, 3 F. R. 2052, and Amdt. 21-6, 7 F. R. 3923]

§ 21.32 *Time and place.* All examinations and tests will be held at such times and places as the Administrator may designate.

§ 21.33 *Aircraft used in tests.* The applicant shall furnish a certificated aircraft for any flight test involved. Each such aircraft, used in any test for an air-line transport pilot certificate shall be equipped with dual controls and shall accommodate the applicant and the inspector. Aircraft having only one elevator and aileron control for two seats, or any arrangement whereby all flight and engine controls cannot be handled in a normal or conventional manner from either seat, are not considered as having dual controls for the purpose of flight tests for pilot ratings. Each such aircraft shall have adequate vision for the pilot and check pilot.

[CAR, May 31, 1938, as amended by Reg. 601-A-1, 3 F. R. 2052]

§ 21.34 *Aircraft category rating.* For purposes of specifying the category of aircraft which the applicant is deemed competent to pilot and for convenience in examining and rating the applicant with respect thereto, aircraft are categoried as follows:

(a) Airplane;
(b) Autogiro;
(c) Glider;
(d) Lighter-than-air aircraft.

[Amdt. 115, 6 F. R. 2872, as amended by Amdt. 21-6, 14 F. R. 2194]

§ 21.35 *Airplane class and type rating*—(a) *Airplane class rating.* For purposes of specifying the class of airplane which the applicant is deemed competent to pilot and for convenience in examining and rating the applicant with respect thereto, airplanes are classed as follows:

(1) Single-engine, land;
(2) Single-engine, sea;
(3) Multiengine, land;
(4) Multiengine, sea;
(5) Unconventional.

(b) *Type rating.* An aircraft type rating shall be issued for each type of aircraft having a maximum certificated take-off weight of over 12,500 lbs.

[Amdt. 115, 6 F. R. 2872, as amended by Amdt. 21-6, 14 F. R. 2194]

§ 21.36 *Inspection.* The applicant for an air-line transport pilot certificate shall offer full cooperation in respect of any inspection or examination which may be made of said applicant upon proper demand by any authorized representative of the Administrator prior or subsequent to the issuance of such certificate.

[CAR, May 31, 1938, as amended by Reg. 601-A-1, 3 F. R. 2052]

§ 21.37 *Standard of performance.* Every practical and theoretical examination and test shall be accomplished to the satisfaction of the Administrator and the minimum passing grade in the subject of examination or test shall be 70 percent. Each flight maneuver will be graded separately. Other examinations will be graded as a whole.

§ 21.38 *Reports.* The person giving any examination or test in behalf of the Administrator will report the result thereof upon an appropriate form to the Administrator and all data collected incident to such examination or test will be considered as of a confidential nature by such person and by all employees of the Civil Aeronautics Authority.

PILOT REGULATIONS

§ 21.40 *Certificated air-line transport pilots*—(a) *Rating limitations.* No certificated air-line transport pilot shall operate any aircraft other than in accordance with the rating limitations set forth in his pilot certificate: *Provided,* That the holder of a valid air-line transport pilot certificate may pilot airplanes:

(1) As a second pilot without an airplane class and horsepower rating for the particular airplane operated;

(2) As a first pilot of a class or within a horsepower range other than that specified in his air-line transport pilot certificate, but he shall not carry any person in such airplanes other than members of the crew thereof, certificated airmen carried in air carrier airplanes in furtherance of their official duties, or a certificated instructor rated for the airplane operated.

(b) *Periodic physical examinations.* A certificated air-line transport pilot shall not pilot an aircraft in operations for which he is required to possess an air-line transport pilot rating unless, within the preceding 6 calendar months, he has met the physical requirements of this part by passing an examination given by an authorized air-line medical examiner of the Administrator.

(c) *Medical certificate.* A medical certificate issued by an authorized air-line medical examiner of the Administrator or other evidence satisfactory to the Administrator that the pilot has met the physical requirements of this part shall be carried by such pilot while piloting aircraft.

[Amdt. 115, 6 F. R. 2872, Amdt. 21-6, 7 F. R. 3923, and Amdt. 21-4, 12 F. R. 3170]

§ 21.41 *Passenger carrying.* A certificated air-line transport pilot shall not pilot any aircraft carrying any person other than members of the crew thereof, certificated airmen carried in air carrier aircraft in furtherance of their official duties, or a certificated instructor rated for the aircraft operated, unless, within the 90 days immediately preceding, he shall have made at least 3 take-offs, and 3 landings to a full stop, in an aircraft of the same category (§ 21.34) and if an airplane, within the same class (§ 21.35 (a)) as that of the aircraft in which any such person is carried.

[Amdt. 115, 6 F. R. 2872, as amended by Amdt. 21-6, 14 F. R. 2194]

§ 21.42 *Recent experience requirements*—(a) *Passenger flight (day and night).* A certificated airline transport pilot shall not pilot an aircraft carrying any person other than the members of the crew thereof, certificated airmen carried in air carrier aircraft in furtherance of their official duties, or a certificated instructor rated for the aircraft operated, unless within the preceding 3 calendar months he shall have made and logged at least 3 take-offs and landings to a full stop in an aircraft of the same category, class, and type as that of the aircraft in which such person is carried. A certificated airline transport pilot shall not pilot such aircraft between sunset and sunrise unless he has made at least one of the 3 required take-offs and landings between sunset and sunrise.

(b) *Instrument flight.* A certificated airline transport pilot, who within the preceding 6 calendar months has not flown and logged at least 2 hours of flight time solely by reference to instruments under either actual or properly simulated instrument flight conditions, shall not pilot an aircraft under such conditions until he has flown and logged at least 2 hours of such flight time accompanied by a certificated pilot of at least private grade holding an appropriate category, class, and type rating for the aircraft and authorized to operate aircraft under instrument conditions.

[Amdt. 27-7, 7 F. R. 5037, as amended by Amdt. 21-6, 14 F. R. 2194]

§ 21.43 *Instruction.* No person holding a valid air-line transport pilot certificate shall give flying instruction, except as provided for in § 21.22 (c), unless possessed of a valid instructor rating.

[CAR, May 31, 1938, as amended by Reg. 601-A-1, 3 F. R. 2052 and Amdt. 21-9, 7 F. R. 6632]

§ 21.44 *Logbooks.* The following rules will govern pilot logbooks:

(a) *General.* Every certificated air-line transport pilot shall keep an accurate record of his flying time in a logbook in which the entries as to solo flying time have been certified to by him and the entries as to instruction have been certified to by his instructor. Logbooks shall be bound records and the entries shall be accurate, legible, in ink or indelible pencil, and so arranged as to facilitate easy reference thereto.

(b) *Contents.* The logbook shall contain the date of flight, the category, class, and type of aircraft flown, the aircraft certificate number, a statement of pilot in command, dual instruction, instrument and night flight time, the duration of the flight, the points between which such flight was made, and, in addition, when any flight results in serious damage to the aircraft, a notation to this effect. Dual instruction time shall be logged in the same manner and, in addition, the instructor shall make complete entries in the logbook of his student showing the nature of each maneuver in which instruction was given and the time spent thereon. The instructor shall attest each such entry with his initials, pilot certificate number, and pertinent rating. This logbook shall be presented for inspection, upon demand and reasonable notice, to any authorized representative of the Administrator or Board or State or municipal officer enforcing local regulations or laws involving Federal compliance.

(c) *Logging of pilot flight time.* The holder of an airline transport pilot certificate may log the total flight time while acting as pilot in command or co-pilot.

(d) *Logging instrument flight time.* Instrument flight time may be logged as such only when the aircraft is flown solely by reference to instruments either under actual or properly simulated flight conditions. (Over-the-top flying shall not be logged as instrument flight time.)

(e) *Reports.* The holder of an air-line transport pilot certificate shall furnish the authorized air-line medical examiner of the Administrator, at the time of each physical examination to be forwarded by him to the Administrator, a report setting forth the amount and type of his aeronautical experience and such other pertinent data as the Administrator may require since his last preceding report.

[CAR, May 31, 1938, as amended by Amdt. 115, 6 F. R. 2872, Amdt. 21-4, 7 F. R. 740, Amdt. 21-7, 7 F. R. 5038, and Amdt. 21-6, 14 F. R. 2194]

DEFINITIONS

§ 21.50 *Definitions.* As used in this part the words listed below shall be defined as follows:

[Amdt. 21-6, 14 F. R. 2194]

§ 21.51 *Category.* Category shall indicate a classification of aircraft such as airplane, helicopter, glider, etc.

[Amdt. 21-6, 14 F. R. 2194]

§ 21.52 *Class.* Class shall indicate a difference in basic design of aircraft within a category, such as single-engine land, multi-engine sea, etc.

[Amdt. 21-6, 14 F. R. 2194]

§ 21.53 *Flight time.* Flight time shall mean the total time from the moment the aircraft first moves under its own power for the purpose of flight until the moment it comes to rest at the end of the flight (block to block).

[Amdt. 21-6, 14 F. R. 2194]

§ 21.54 *Maximum certificated take-off weight.* The maximum certificated take-off weight shall mean the maximum take-off weight authorized by the terms of the aircraft airworthiness certificate.

[Amdt. 21-6, 14 F. R. 2194]

§ 21.55 *Night.* Night is the time between the ending of evening twilight and the beginning of morning twilight as published in the Nautical Almanac converted to local time for the locality concerned.[2]

[Amdt. 21-6, 14 F. R. 2194]

§ 21.56 *Pilot in command.* Pilot in command shall mean the pilot responsible for the operation and safety of the aircraft during the time defined as flight time.

[Amdt. 21-6, 14 F. R. 2194]

§ 21.57 *Solo flight time.* Solo flight time shall mean the flight time during which a pilot is the sole occupant of an aircraft.

[Amdt. 21-6, 14 F. R. 2194]

§ 21.58 *Type.* Type shall mean all aircraft of the same basic design including all modifications thereto except those modifications which result in a change in handling or flight characteristics.

[Amdt. 21-6, 14 F. R. 2195]

PART 22—LIGHTER-THAN-AIR PILOT CERTIFICATES

AUTHORITY: §§ 22.1 to 22.42, issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 601, 602, 52 Stat. 1007, 1008, 49 U. S. C. 551, 552.

SOURCE: §§ 22.1 to 22.42 contained in Amendment 127, 6 F. R. 4558, except as noted following sections affected.

CLASSIFICATION OF LIGHTER-THAN-AIR PILOT CERTIFICATES

§ 22.1 *Grades.* Lighter-than-air pilot certificates are classified in the following grades:

(a) Student lighter-than-air pilot certificate.

(b) Private lighter-than-air pilot certificate.

(c) Commercial lighter-than-air pilot certificate.

(d) Free balloon pilot certificate.

LIGHTER-THAN-AIR PILOT CERTIFICATE REQUIREMENTS

§ 22.10 *Student lighter-than-air pilot certificate.* To be eligible for a student lighter-than-air pilot certificate an applicant shall comply with the following requirements:

(a) *Age.* Applicant shall be at least 16 years of age. If applicant be less than 21 years of age at the time of making application, he shall submit with his application the written consent of either parent, or legal or natural guardian to the issuance of the pilot certificate sought.

(b) *Character.* Applicant shall not be temperamentally unsuited for flying.

(c) *Citizenship.* Applicant shall be:

(1) A citizen of and of unquestionable loyalty to the United States, or

(2) A person who is in sympathy with the objectives of the United States and who is a trustworthy citizen of a friendly foreign government not under the domination of or associated with any government with which the United States is at war.

(d) *Education.* If an applicant is unable to read, speak, and understand the English language, appropriate operation limitations may be entered upon his student lighter-than-air pilot certificate.

(e) *Physical condition.* Applicant shall meet the physical standards of the Third Class prescribed in Part 29 of this subchapter.

(f) *Aeronautical knowledge.* No requirement is prescribed.

(g) *Aeronautical experience.* No requirement is prescribed.

(h) *Aeronautical skill.* No requirement is prescribed.

[Amdt. 127, 6 F. R. 4558 as amended by Amdt. 22-1, 22-2, 22-3, 7 F. R. 989 and Amdt. 22-5, 7 F. R. 3924]

§ 22.11 *Private lighter-than-air pilot certificate.* To be eligible for a private lighter-than-air pilot certificate an applicant shall comply with the following requirements:

(a) *Age.* Applicant shall be at least 18 years of age. If applicant be less than 21 years of age at the time of making application, he shall submit with his application the written consent of either parent, or legal or natural guardian to the issuance of the pilot certificate sought.

(b) *Character.* Same as in § 22.10 (b).

(c) *Citizenship.* Same as in § 22 10 (c).

(d *Education.* Applicant shall be able to read, speak, and understand the English language.

(e) *Physical condition.* Applicant shall meet the physical standards of the Third Class prescribed in Part 29 of this subchapter.

(f) *Aeronautical knowledge.* Applicant shall pass a written examination covering so much of the provisions of this part and Parts 1 and 60 of this subchapter as are pertinent to his certificate, prevailing weather conditions in the United States as encountered in flying, and the forecasting thereof, the analyzing of weather maps and sequence reports as furnished by the United States Weather Bureau, practical air navigation problems and the use of maps, navigation by terrain (pilotage) and by dead reckoning, including the use of instruments and other aids to navigation in visual-contact flying, and the general servicing and operation of airships.

(g) *Aeronautical experience.* Applicant shall have logged at least 50 flight hours actually at the controls of airships, including not less than 5 hours of solo flight and not less than 5 hours of cross-country flight. At least 5 hours of such time shall have been logged within the 60 days immediately preceding the date of filing the application.

(h) *Aeronautical skill.* Applicant shall satisfactorily demonstrate his ability to pilot airships in solo flight and in addition to normal take-offs and landings to perform satisfactorily the following maneuvers:

(1) A series of right and left turns and figure eights;

(2) Ascents and descents at rates up to 600 feet per minute not permitting gas pressure to exceed $1\frac{1}{2}$ inches of water during ascents or to fall below 1 inch of water during descents;

(3) Land the airship 200 pounds heavy and 200 pounds light;

(4) Such other maneuvers as the Administrator deems necessary.

(i) *Military competence.* An applicant for a private lighter-than-air pilot certificate on the basis of military competence shall be deemed to have met the aeronautical knowledge, experience, and skill requirements of the Civil Air Regulations for the issuance of such certificate, if he passes a written examination on Parts 43 and 60 of this subchapter and presents reliable documentary evidence showing:

[2] The Nautical Almanac containing the ending of evening twilight and the beginning of morning twilight tables may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Information concerning such tables is also available in the offices of the Civil Aeronautics Administration or the U. S. Weather Bureau.

(1) That he is a member of the armed forces of the United States or a civilian employee of the ferry or transport services of such forces, and is on solo flying status as a rated lighter-than-air pilot or the equivalent, or

(2) That he has been honorably discharged or released from such forces and has had at least 10 hours as sole manipulator of the controls of a military lighter-than-air aircraft within the preceding 12 months.

[Amdt. 127, 6 F. R. 4558, as amended by Amdt. 22-5, 7 F. R. 3924, and Amdt. 22-3, 13 F. R. 2791]

§ 22.12 *Commercial lighter-than-air pilot certificate.* To be eligible for a commercial lighter-than-air pilot certificate an applicant shall comply with the following requirements:

(a) *Age.* Applicant shall be at least 18 years of age. If applicant be less than 21 years of age at the time of making application, he shall submit with his application the written consent of either parent, or legal or natural guardian to the issuance of the pilot certificate sought.

(b) *Character.* Applicant shall not be temperamentally unsuited for flying.

(c) *Citizenship.* Applicant shall be a citizen of the United States or of a foreign government which grants or has undertaken to grant reciprocal commercial lighter-than-air pilot privileges to citizens of the United States on equal terms and conditions with citizens of such foreign government.

(d) *Education.* Applicant shall be able to read, speak, write, and understand the English language.

(e) *Physical condition.* Applicant shall meet the physical standards of the Second Class prescribed in Part 29 of this subchapter.

(f) *Aeronautical knowledge.* The same as in § 22.11 (f) and, in addition, the applicant shall pass a written examination on the theory and practice of flight, the maintenance of nonrigid airships and the maintenance and proper use of airship power units, the use of such instruments and other navigational aids, both in airships and on the ground, necessary for the navigation of airships by instrument, and meteorology as applied to weather analysis and forecast.

(g) *Aeronautical experience.* Applicant shall show a total of at least 200 hours of flight time actually at the controls of airships of which at least 5 hours shall have been logged within the 60 days immediately preceding the date of the filing of the application and including:

(1) Not less than 50 hours in solo flight;

(2) Not less than 10 hours in cross-country flight;

(3) Not less than 10 hours in flight during the hours of darkness;

(4) Not less than 20 hours of instrument instruction and practice in flight: *Provided,* That not more than 10 hours of this requirement may be instruction and practice under simulated conditions not in flight when approved by the Administrator; and

(5) In lieu of not to exceed 50 hours of the 200-hour total flight time requirement, applicant may show an equal or greater amount of flight time while participating as a crew member when acceptable to the Administrator.

(h) *Aeronautical skill.* Same as in § 22.11 (h) except that:

(1) In the maneuvers required by § 22.11 (h) (1) the altitude of the ship shall not vary up or down in excess of 100 feet of the assigned flight altitude.

(2) In the maneuvers required by § 22.11 (h) (2) ascents and descents at rates up to 1,200 feet per minute shall be made under the same pressure limitations.

(3) Applicant shall also demonstrate satisfactorily his ability to perform, solely by instrument, the following:

(i) Straight, level flight for given period of time;

(ii) Moderate 180- and 360-degree precision turns in both directions;

(iii) Ascents and descents at rates up to 1000 feet per minute;

(iv) Climbing and diving turns and recovery therefrom;

(v) Estimating arrival time taking into account wind, air speed, and drift while in flight or under simulated conditions;

(vi) Such other maneuvers as the Administrator deems necessary.

(i) *Radio skill.* Applicant shall demonstrate satisfactorily his ability to perform while in flight the following:

(1) Tuning radio;

(2) Orientation;

(3) Following radio range;

(4) Locating cone of silence;

(5) Letting-down-through on the range by a satisfactory airship instrument approach procedure for the particular airport used in connection with the test; and

(6) Such other maneuvers as the Administrator deems necessary.

(j) *Military competence.* An applicant for a commercial lighter-than-air pilot certificate on the basis of military competence shall be deemed to have met the aeronautical knowledge, experience, and skill requirements of the regulations in this subchapter for the issuance of such certificate, if he passes a written examination on Parts 43 and 60 of this subchapter and presents reliable documentary evidence showing:

(1) That he is a member of the armed forces of the United States and that he has been on active duty on solo flying status as a rated lighter-than-air pilot with unlimited instrument privileges for a period of at least 6 consecutive months immediately preceding application, or

(2) That he has been honorably discharged or released from such forces and had been on active duty of the type specified in subparagraph (1) of this paragraph for the period of at least 6 consecutive months within 18 months immediately preceding application.

[Amdt. 127, 6 F. R. 4558 as amended by Amdt. 22-5, 7 F. R. 3924, Amdt. 22-3, 13 F. R. 2791 and Amdt. 22-4, 13 F. R. 4313]

§ 22.13 *Free balloon pilot certificate.* To be eligible for a free balloon pilot certificate an applicant shall comply with the following requirements:

(a) *Age.* Same as § 22.11 (a).

(b) *Character.* Applicant shall not be temperamentally unsuited for flying.

(c) *Citizenship.* Same as § 22.10 (c).

(d) *Education.* Applicant shall be able to read, speak, write, and understand the English language.

(e) *Physical condition.* Same as § 22.11 (e).

(f) *Aeronautical knowledge.* Same as § 22.11 (f).

(g) *Aeronautical experience.* Applicant shall have had a minimum of 6 instruction flights in free balloons of not less than 1 hour duration each and shall have logged at least 1 hour of actual solo flight time within the 90 days immediately preceding the date of filing the application. The date of such solo flight shall be certified to by the instructor on the student lighter-than-air pilot certificate.

(h) *Aeronautical skill.* Applicant shall demonstrate satisfactorily his ability to pilot and maneuver a free balloon in actual solo flight.

[Amdt. 127, 6 F. R. 4558, as amended by Amdt. 22-1, 22-2, 22-3, 7 F. R. 989]

LIGHTER-THAN-AIR PILOT CERTIFICATES

§ 22.20 *Application.* Application for a lighter-than-air pilot certificate shall be made upon the form prescribed and furnished by the Administrator.

(a) *Revocation.* No person whose lighter-than-air pilot certificate has been revoked shall apply for or be issued a pilot certificate for a period of 1 year after the revocation except as the order of revocation may otherwise provide.

(b) *Nontransferability.* A lighter-than-air pilot certificate is not transferable.

§ 22.21 *Duration.* (a) A student lighter-than-air pilot certificate shall expire 24 calendar months after the month of issuance.

(b) A private or commercial lighter-than-air pilot certificate or free balloon pilot certificate shall remain in effect unless it is suspended, or revoked, or a general termination date for such certificate is fixed by the Board.

(c) The Administrator or his authorized representative may issue a temporary lighter-than-air pilot certificate for a period of not to exceed 90 days subject to the terms and conditions specified therein by the Administrator.

§ 22.22 *Recent experience requirements*—(a) *General.* (1) A student who has not piloted an airship within 90 days shall not pilot such aircraft in solo flight until he has passed a flight check given by a commercial lighter-than-air pilot and that fact has been endorsed by such pilot in the student pilot logbook.

(2) The holder of a private or commercial lighter-than-air pilot certificate shall not pilot an airship carrying passengers, unless within the preceding 90 days he has had at least 5 take-offs and landings.

(b) *Night flight.* No person shall pilot a lighter-than-air aircraft carrying passengers during the period from one hour after sunset to one hour before sunrise, unless he has made at least 5 take-offs and landings to a full stop during the hours of darkness within the preceding 90 days.

(c) *Instrument flight.* A pilot shall not pilot an airship under instrument flight rules, unless he has had at least 6 hours of instrument flight under actual or simulated instrument conditions during the preceding 6 calendar months. At least 50 percent of the above required time must have been accomplished in actual flight.

[Amdt. 22-2, 12 F. R. 1029]

§ 22.23 *Reinstatement.* A private or commercial lighter-than-air pilot certificate or a free balloon pilot certificate which was effective on or after January 1, 1942, and has expired, may be reinstated upon application to an authorized representative of the Administrator prior to February 1, 1948.

[Amdt. 22-2, 12 F. R. 1029]

§ 22.24 *Examinations and tests*—(a) *General procedure.* The examinations and tests prescribed in this part shall be conducted by an authorized officer or employee of the Administrator or by a properly qualified person designated for the purpose by the Administrator. All examinations and tests will be held at such times and places as the Administrator may designate.

(b) *Physical examination.* Prior to taking a flight test for a lighter-than-air pilot certificate, an applicant shall have met the appropriate physical requirements within the time limitations hereinafter prescribed:

(1) *Private lighter-than-air pilot certificate.* Within the preceding 24 months.

(2) *Commercial lighter-than-air pilot certificate.* Within the preceding 12 months.

(c) *Reexaminations.* (1) An applicant for a private or commercial lighter-than-air pilot certificate or for a free balloon pilot certificate who has failed to pass any prescribed theoretical examination may apply for reexamination at any time after 30 days of the day of failure or after he has received not less than 5 hours instruction on each subject of the examination failed from a certificated ground instructor rated for such subject and presents a statement from such instructor showing the amount of instruction given and stating that he deems the applicant qualified to pass the required examination in such subject.

(2) An applicant for a private or commercial lighter-than-air pilot certificate or for a free balloon pilot certificate who has failed to pass any practical examination or test may apply for reexamination only after he has logged at least 3 additional hours of flight time.

(d) *Aircraft used in tests.* The applicant shall furnish suitable certificated aircraft for any flight test required.

[Amdt. 127, 6 F. R. 4558, as amended by Amdt. 22-4, 7 F. R. 3258, Amdt. 22-5, 7 F. R. 3924, and Amdt. 22-5, 14 F. R. 110]

PILOT REGULATIONS

§ 22.31 *Flight limitations and privileges*—(a) *Student lighter-than-air pilot.* (1) The holder of a student lighter-than-air pilot certificate shall not operate a free balloon in solo flight until:

(i) He has demonstrated thorough familiarity with the provisions of Part 60 of this subchapter dealing with contact flight by passing a written examination of such provisions and such fact has been certified to by his instructor on the student lighter-than-air pilot certificate;

(ii) He shall have had a minimum of six instruction flights in free balloons of not less than 1 hour duration each and such fact has been certified to by his instructor on the student pilot certificate.

(2) The holder of a student lighter-than-air pilot certificate shall not pilot an airship in solo flight until:

(i) He has demonstrated thorough familiarity with the provisions of Part 60 of this subchapter dealing with contact flight by passing a written examination of such provisions and such fact has been certified to by his instructor on the student lighter-than-air pilot certificate;

(ii) He shall have had a minimum of six instruction flights in free balloons of not less than 1 hour duration each and shall have logged at least 1 hour of actual solo flight in a free balloon and such fact shall be certified to by his instructor on the student lighter-than-air pilot certificate. If the student pilot possesses a free balloon pilot certificate such certification shall not be required;

(iii) He shall have had a minimum of 35 hours of dual instruction in airships which shall include level flight, right and left turns, landing and take-offs, and shall be deemed competent by his instructor to make such flight, which fact shall be certified to by his instructor on the student lighter-than-air pilot certificate.

(3) The holder of a student lighter-than-air pilot certificate shall not pilot any lighter-than-air aircraft carrying any person other than a certificated commercial lighter-than-air pilot, a member of the crew, or another certificated student lighter-than-air pilot whose presence in the aircraft is authorized by the instructor under whose direction the flight is being made. Such person shall not pilot any lighter-than-air aircraft for hire.

(b) *Private lighter-than-air pilot.* (1) The holder of a private lighter-than-air pilot certificate shall not pilot an airship carrying any persons or property for hire nor give any flight or instrument instruction therein.

(2) The holder of such certificate may pilot a free balloon for hire and may give flight instruction therein.

(c) *Commercial lighter-than-air pilot.* The holder of a commercial lighter-than-air pilot certificate may pilot for hire any lighter-than-air aircraft carrying passengers or property and may give either flying instruction or instrument instruction therein.

(d) *Free balloon pilot.* The holder of a free balloon pilot certificate shall not pilot any lighter-than-air aircraft except a free balloon but may pilot a free balloon for hire carrying passengers or property and give flight instruction therein.

(e) *Medical certificate and renewal.* Any person while piloting a lighter-than-air aircraft shall have on his person a medical certificate or other evidence satisfactory to the Administrator showing that he has met the physical requirements within the following time limits:

(1) Student pilot, private pilot, or free balloon pilot—24 calendar months.

(2) Commercial pilot—12 calendar months.

[Amdt. 127, 6 F. R. 4558, as amended by Amdt. 22-2, 12 F. R. 1029]

§ 22.32 *Miscellaneous.*—(a) *Display.* The holder of any lighter-than-air pilot certificate shall keep his certificate in his personal possession at all times when piloting lighter-than-air aircraft and shall present the same for inspection upon request of any passenger, any authorized officer or employee of the Administrator or Board and of any State or municipal official charged with the duty of enforcing local laws or regulations involving Federal compliance.

(1) *Medical certificate.* A medical certificate issued by an authorized medical examiner of the Administrator or other evidence satisfactory to the Administrator that the pilot has met the appropriate physical requirements prescribed in this part shall be carried by such pilot while piloting aircraft.

(b) *Surrender.* The holder of a lighter-than-air pilot certificate shall surrender, upon request, such certificate to any officer or employee of the Administrator if it has been suspended or revoked or if it has expired.

(c) *Operation during physical deficiency.* The holder of a lighter-than-air pilot certificate shall not pilot any lighter-than-air aircraft during the period of any known physical deficiency which would render him during that period unable to meet the physical requirements with which he complied in order to secure his certificate.

(d) *Inspection.* An applicant for, or the holder of, a lighter-than-air pilot certificate shall offer full cooperation with respect to any inspection or examination which may be made of such person upon proper request by any authorized representative of the Administrator.

(e) *Simulated instrument flight.* No person shall pilot a lighter-than-air aircraft in flight under simulated instrument conditions unless a certificated lighter-than-air safety pilot shall be present at all times and have ready access to the controls and adequate vision from the aircraft.

(f) *Logbooks.* Every certificated lighter-than-air pilot and every person receiving flight instruction shall keep an accurate record of his flying time in a logbook in which the entries with respect to solo flying time shall be certified to by him and such entries respecting dual instruction shall have been certified to by the lighter-than-air pilot giving the instruction. This logbook shall be presented for inspection upon request and reasonable notice to any authorized representative of the Administrator or Board or of any State or municipal officer enforcing local regulations or laws involving Federal compliance.

(1) *Form.* Such logbook shall be a bound record and the entries shall be accurate, legible, and in ink or indelible pencil so arranged as to facilitate easy reference thereto.

(2) *Content.* The logbook shall contain entries including at least the follow-

ing: The date of flight; the make and model of the lighter-than-air aircraft flown; the aircraft identification mark; a statement classifying the type of flight (whether solo, dual instruction, instrument, or night flying time); the duration of the flight; the points between which such flight was made; and, in addition, when any flight results in serious damage to the aircraft, a notation to this effect.

(3) *Logging of flight time.* No flight time shall be logged as such unless the lighter-than-air aircraft flown is a public or certificated aircraft.

(4) *Logging of instrument flight time.* No instrument flight time shall be logged as such unless the lighter-than-air aircraft is flown solely by reference to instruments either under actual or properly simulated flight conditions. Over-the-top flying shall not be logged as instrument flight time.

[Amdt. 127, 6 F. R. 4558 as amended by Amdt. 22-5, 7 F. R. 3923]

DEFINITIONS

§ 22.40 *Lighter-than-air aircraft.* A lighter-than-air aircraft is an aircraft whose support is chiefly due to buoyancy derived from aerostatic forces.

(a) *Free balloon.* A free balloon, as used in this part, shall mean a lighter-than-air aircraft not restrained from free flight by any connection with the ground nor equipped with any power plant or propelling device, the ascent and descent of which may be controlled by releasing ballast or gas and the direction of flight of which is determined by the wind.

(b) *Airship.* An airship, as used in this part, shall mean a lighter-than-air aircraft other than a fixed or free balloon.

§ 22.41 *Solo flight time.* Solo flight time, as used in this part, shall mean flight time when the pilot is in command and actually at the controls of the lighter-than-air aircraft regardless of the presence of any other crew members in the aircraft who may act under his direction.

(a) *Actual solo flight time.* Actual solo flight time, as used in this part, shall mean flight time when the pilot is the sole occupant of the lighter-than-air aircraft.

§ 22.42 *Dual instruction.* Dual instruction, as used in this part, shall mean flight time as a student at the controls of a lighter-than-air aircraft under the immediate direction of a pilot who is in command of the aircraft and authorized to give instruction therein.

PART 24—MECHANIC CERTIFICATES

AUTHORITY: §§ 24.1 to 24.46 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 601, 602, 52 Stat. 1007, 1008; 49 U. S. C. 551, 552.

SOURCE: §§ 24.1 to 24.46 contained in Amendment 39, Civil Air Regulations, 5 F. R. 684, as amended by Amendment 75, 5 F. R. 3946, except as noted following sections affected.

REQUIREMENTS

§ 24.1 *Mechanic certificate requirements.* To be eligible for a mechanic certificate, an applicant shall comply with the following requirements:

(a) *Age.* Applicant shall be at least 18 years of age.

(b) *Character.* Applicant shall be of good moral character.

(c) *Citizenship.* Applicant shall be a citizen of the United States or of a foreign government which grants or has undertaken to grant reciprocal mechanic privileges to citizens of the United States on equal terms and conditions with citizens of such foreign government.

(d) *Education.* Applicant shall be able to read, write, speak, and understand the English language: *Provided, however,* That this requirement shall not apply to an applicant employed by an air carrier outside the United States, and that Airmen Rating Records issued to such applicants as may be unable to read, write, speak, or understand the English language shall bear the following notation: "Valid only outside the United States while employed by an air carrier".

(e) *Other requirements.* Applicant shall comply with the requirements prescribed in this part for the particular mechanic rating sought.

[Amdt. 39, 5 F. R. 684 as amended by Amdt. 73, 5 F. R. 3763, Amdt. 24-7, 7 F. R. 988, Amdt. 24-3, 13 F. R. 4314]

RATINGS

NOTE: Regulation Serial No. SR-332, 14 F. R. 3193, provides as follows:

A mechanic certificate with a propeller or aircraft appliance rating, excepting a parachute rating, may be issued by the Administrator of Civil Aeronautics to an individual who is employed and designated by either a manufacturer holding a currently effective propeller or aircraft appliance production certificate or by an applicant for, or the holder of, a repair station certificate with a propeller or aircraft appliance rating. The individual must be in direct charge of the inspection, overhaul, or repair of propellers or aircraft appliances, and his experience and employment record must indicate that he is competent to engage in such activity. The individual to whom a certificate is issued shall exercise the privileges of his certificate only with respect to the work performed for such manufacturer or repair station and through the use of facilities provided by the manufacturer or repair station.

This regulation supersedes Special Civil Air Regulation Serial No. SR-324, as amended, and shall terminate December 31, 1949.

§ 24.10 *Mechanic ratings.* Mechanic ratings are as follows:

(a) Aircraft mechanic rating;
(b) Aircraft engine mechanic rating;
(c) Factory mechanic rating.

§ 24.11 *Aircraft mechanic rating.* To be eligible for an aircraft mechanic rating, an applicant shall comply with the following requirements:

(a) *Aeronautical knowledge.* Applicant shall have theoretical and practical knowledge of aircraft structure and rigging, including the control systems, and aircraft appliances, shall know how properly to inspect, maintain, and repair the same, and shall be generally familiar with the provisions of Parts 4a, 4b and 15, and thoroughly familiar with the provisions of Part 1 dealing with aircraft airworthiness and the provisions of Parts 18 and 24 of this subchapter.

(b) *Aeronautical experience.* Applicant shall have had at least 1 year of practical experience, or what is deemed by the Administrator to be its equivalent, in the construction, inspection, maintenance, or repair of aircraft and aircraft appliances.

(c) *Aeronautical skill.* Applicant shall satisfactorily demonstrate, by means of written, oral, and practical tests, his ability with respect to the subject matters prescribed in paragraph (a) of this section.

§ 24.12 *Aircraft engine mechanic rating.* To be eligible for an aircraft engine mechanic rating, an applicant shall comply with the following requirements:

(a) *Aeronautical knowledge.* Applicant shall have theoretical and practical knowledge of aircraft power plants, propellers, and their appliances, shall know how properly to inspect, maintain, and repair the same, and shall be generally familiar with the provisions of Parts 4a, 4b, 13, and 14, and thoroughly familiar with the provisions of Part 1 dealing with aircraft airworthiness and the provisions of Parts 18 and 24 of this subchapter.

(b) *Aeronautical experience.* Applicant shall have had at least 1 year of practical experience, or what is deemed by the Administrator to be its equivalent, in the construction, inspection, maintenance, or repair of aircraft engines, propellers, and their appliances.

(c) *Aeronautical skill.* Applicant shall satisfactorily demonstrate, by means of written, oral, and practical tests, his ability with respect to the subject matters prescribed in paragraph (a) of this section.

[Amdt. 39, 5 F. R. 684, as amended by Amdt. 24-1, 8 F. R. 1303]

§ 24.13 *Factory mechanic rating.* To be eligible for a factory mechanic rating, applicant must be employed by and designated by a manufacturer holding a currently effective production certificate, as in direct charge of the inspection, maintenance, overhaul, or repair of aircraft, aircraft engines, propellers, or instruments constructed by such manufacturer. The experience and employment record of the applicant must indicate that he is competent to engage in such activity.

[Amdt. 39, 5 F. R. 684, as amended by Amdt. 109, 6 F. R. 2560]

MECHANIC CERTIFICATE

§ 24.20 *Application.* Application for a mechanic certificate shall be made upon the applicable form prescribed and furnished by the Administrator.

(a) *Application to amend.* When any change in an Airman Rating Record [1] is desired, the applicant shall file a written request therefor upon the applicable form prescribed and furnished by the Administrator.

§ 24.21 *Display.* A mechanic certificate shall be kept readily available to the mechanic at all times when he is serving in connection with certificated aircraft, aircraft engines, propellers, appliances, or parachutes and shall be presented for inspection upon the reasonable request of any person.

§ 24.22 *Duration.* A mechanic's certificate shall be of 60 days' duration, and unless the holder is otherwise notified by the Administrator within such period, it shall continue in effect thereafter until otherwise specified by the Board, unless suspended or revoked: *Provided,* That a factory mechanic's rating shall terminate at any time that the holder thereof ceases to be employed by the manufacturer to whose products the rating is limited or whenever the facilities of such manufacturer are no longer available to or in use by the holder.

[Amdt. 24-10, 7 F. R. 5080]

§ 24.23 *Temporary certificates.* The Administrator or his authorized representative may issue a temporary mechanic certificate for a period of not to exceed 90 days, subject to the terms and conditions specified therein by the Administrator.

[Amdt. 24-2, 12 F. R. 4431]

§ 24.24 *Nontransferability.* A mechanic certificate is not transferable.

§ 24.25 *Surrender.* Upon the suspension, revocation, or expiration of a mechanic certificate, the holder thereof shall surrender such certificate, upon request, to any officer or employee of the Administrator.

§ 24.26 *Reexamination.* An applicant for a mechanic certificate or rating who has failed any prescribed practical or theoretical examination or test may apply for reexamination at any time after the expiration of 30 days from the date of such failure: *Provided,* That an applicant who has failed only the examination on the pertinent Civil Air Regulations (the regulations in this subchapter) may apply for reexamination on the Civil Air Regulations after he has received not less than 5 hours instruction on the Civil Air Regulations from a certificated ground instructor and presents a statement from such instructor showing the amount of instruction given and stating that he deems the applicant qualified to pass the required examination.

§ 24.27 *Revocation.* No person whose mechanic certificate has been revoked shall apply for or be issued a mechanic certificate of any rating for a period of 1 year after the revocation, except as the order of revocation may otherwise provide.

[Amdt. 87, 5 F. R. 5256]

EXAMINATIONS AND TESTS

§ 24.30 *General.* The examinations and tests prescribed in this part will be conducted by an authorized representative of the Administrator.

§ 24.31 *Time and place.* All examinations and tests will be held at such times and places as the Administrator or his representative may prescribe.

§ 24.32 *Inspection.* The applicant for a mechanic certificate or rating shall offer full cooperation with respect to any inspection and examination which may be made of such applicant upon proper request by any authorized representative of the Administrator prior or subsequent to the issuance of a mechanic certificate or rating.

§ 24.33 *Standard of performance.* All practical or theoretical examinations and tests shall be accomplished to the satisfaction of the Administrator, and the passing grade in each subject of examination or test shall be at least 70 percent.

MECHANIC REGULATIONS

§ 24.40 *Airman Rating Record requirement.* A certificated mechanic who is directly in charge of packing parachutes or of the inspection, maintenance, or repair of certificated aircraft, aircraft engines, or their appliances, shall not engage in such service unless there is attached to his certificate the appropriate Airman Rating Record, prescribed and issued by the Administrator. Every holder of a valid mechanic certificate, or parachute rigger certificate, in effect on May 1, 1940, may perform service pursuant to such authority without an Airman Rating Record until the expiration, suspension, or revocation of such license or certificate.

§ 24.41 *Parachute packing.* A certificated mechanic holding a currently effective parachute rigger rating shall not repack any parachute which is not in condition for safe use.

§ 24.42 *Major and minor parachute repairs.* A certificated mechanic shall not make any major parachute repairs unless, at the time of making such repairs, he is in the employ of the manufacturer of the parachute or another parachute manufacturer deemed competent for the purpose by the Administrator. Unless prior approval has been obtained from the Administrator, such mechanic shall not pack or repack any parachute, or make any minor parachute repairs, such as the replacement of pack-opening rubbers, packs and pilot chutes, and the patching of holes and tears in silk, in a place other than where the following facilities for such operations are available:

(a) A suitable table, at least 3 feet by 40 feet, with smooth surface;

(b) A rack where parachutes can be suspended for drying and airing;

(c) Packing tools and repair equipment suitable for the repacking and repair of the type of parachute involved;

(d) Adequate housing facilities for the above equipment.

§ 24.43 *Factory mechanic rating limitations.* The holder of a factory mechanic rating shall be limited to the inspection, maintenance, overhaul, or repair of aircraft, aircraft engines, propellers, or instruments constructed by the manufacturer employing the holder. Such work shall be performed only for such manufacturer and through the use of facilities provided by him.

[Amdt. 109, 6 F. R. 2561]

§ 24.44 *Recent experience requirements.* The holder of a mechanic's certificate shall not exercise the privileges thereunder, unless within the preceding twenty-four calendar months he has:

(a) Served as a mechanic under the terms of his certificate and rating for at least six months of such twenty-four-month period, or

(b) Demonstrated to the satisfaction of the Administrator that he is able to meet the standards currently prescribed by the regulations in this subchapter for the issuance of the certificate and rating.

[Amdt. 24-10, 7 F. R. 5080]

§ 24.45 *Reports.* The holder of a mechanic's certificate shall transmit to the Administrator, annually, during the month of January, a report for the preceding twelve-month period, setting forth the amount and type of his aeronautical experience and such other pertinent data as the Administrator may require.

[Amdt. 24-10, 7 F. R. 5080]

§ 24.46 *Expired certificates; special issuance.* The holder of a mechanic's certificate which has expired during the preceding twelve months may obtain a new certificate and the same rating theretofore held immediately prior to its expiration, upon application, by demonstrating to the satisfaction of the Administrator that he is able to meet the standards currently prescribed by the regulations in this subchapter for the issuance of the certificate and rating.

[Amdt. 24-10, 7 F. R. 5080]

PART 25—PARACHUTE TECHNICIAN CERTIFICATES

CERTIFICATES AND RATINGS

[1] Under § 24.40 no certificated mechanic who is directly in charge of packing parachutes or of the inspection, maintenance, or repair of certificated aircraft, aircraft engines, or their appliances, shall engage in such service unless the appropriate Airman Rating Record is attached to his certificate. The Airman Rating Record is a sheet attached to all mechanic certificates when they are issued and will contain the mechanic rating(s) held by the certificate holder.

QUALIFICATIONS FOR PARACHUTE TECHNICIAN CERTIFICATES

AUTHORITY: §§ 25.1 to 25.46 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 601, 602, 52 Stat. 1007, 1008; 49 U. S. C. 551, 552.

SOURCE: §§ 25.1 to 25.46 contained in Amendment 25–0, Civil Air Regulations, 8 F. R. 1332, except as noted following sections affected.

CERTIFICATES AND RATINGS

§ 25.1 *Certification of parachute technicians.* An airman certificate may be issued by the Administrator to a person qualified in accordance with the provisions prescribed in §§ 25.6 through 25.8 to perform the duties of parachute technician.

§ 25.2 *Classification of parachute technicians.* Parachute technicians shall be classified in the following ascending grades:

(a) Parachute rigger;
(b) Senior parachute rigger;
(c) Master of parachute maintenance.

QUALIFICATIONS FOR PARACHUTE TECHNICIAN CERTIFICATES

§ 25.6 *Parachute rigger grade*—(a) *Citizenship.* Applicant shall be a citizen of the United States or of a foreign government which grants or has undertaken to grant reciprocal parachute technician privileges to citizens of the United States on equal terms and conditions with citizens of such foreign government.

(b) *Age.* Applicant shall be not less than 18 years of age.

(c) *Moral character.* Applicant shall be of good moral character.

(d) *Education.* Applicant shall be able to read, write, and understand the English language: *Provided,* That a citizen of Puerto Rico, or an applicant who is employed by an air carrier outside the United States, need not be able to read, write, speak, or understand the English language except that a certificate issued to such an applicant shall be valid only in Puerto Rico, or only while employed by an air carrier outside of the United States, as the case may be.

(e) *Knowledge.* Applicant shall pass a written, oral, and practical examination on (1) the construction, inspection, packing, maintenance, use of, and the manufacturer's instructions with respect to at least one make and type of parachute in common commercial use, and (2) the pertinent provisions of the regulations in this subchapter and related manuals.

(f) *Experience.* Applicant shall have performed satisfactory service in the packing of at least 20 parachutes of each type for which he seeks a rating under the supervision of a properly qualified and certificated parachute technician.

(g) *Military competence.* An applicant who is or was within the 12 months preceding application a regular or reserve member of the Army, Navy, Marine Corps, or Coast Guard on active duty as a parachute technician for a period of not less than one year, upon passing the prescribed written examination on the pertinent regulations in this subchapter and presentation of a statement from the appropriate military authorities attesting to such experience, will be deemed to have met the requirements of paragraphs (e) and (f) of this section.

[Amdt. 25–0, 8 F. R. 1332 as amended by Amdt. 25–3, 11 F. R. 10419, and Amdt. 25–5, 13 F. R. 4313]

§ 25.7 *Senior parachute rigger grade.* Applicant shall comply with the provisions of § 25.6 (a) through (f) and in addition thereto he shall:

(a) Demonstrate to the satisfaction of the Administrator that he has a thorough practical and theoretical knowledge of the construction, inspection, packing, maintenance, use of, and repairs to at least 3 types of parachutes in common commercial use including the manufacturers' instructions with respect to such subject;

(b) Present proof satisfactory to the Administrator that he has served as a properly qualified and certificated parachute technician or as a mechanic with a rating as a parachute rigger for a period of at least 2 years; and

(c) Present proof satisfactory to the Administrator that he has satisfactorily serviced and packed at least 25 parachutes of each make and type for which he seeks to be rated.

§ 25.8 *Master of parachute maintenance grade.* Applicant shall comply with the provisions of § 25.6 (a) through (f) and in addition thereto he shall:

(a) Demonstrate to the satisfaction of the Administrator that he has a thorough practical and theoretical knowledge of the construction, inspection, packing, maintenance, use of, and repairs to the products of not less than 3 different manufacturers including at least 4 types of parachutes and 3 types of canopies, and the ability to properly supervise all operations in connection therewith.

(b) Present proof satisfactory to the Administrator that he has served as a certificated parachute technician for a period of at least 5 years, and that he has satisfactorily serviced and packed not less than 200 parachutes of various makes and types and not less than 25 of each type and make of parachute for which he is rated; and

(c) Present written statements satisfactory to the Administrator attesting to his character, responsibility, skill, ability, and length of service, and recommending him for a "Master of Parachute Maintenance" grade.

QUALIFICATIONS FOR RATINGS

§ 25.11 *Special ratings.* Special parachute ratings are as follows:

(a) Parachute jumper;
(b) Parachute instructor.

§ 25.12 *Parachute jumper rating.* A special rating of parachute jumper will be entered on the Airman Rating Record of a certificated parachute technician who, after inspection and examination, is found by the Administrator to meet the requirements therefor and, if less than 21 years of age, to have obtained the written consent of either parent, or legal or natural guardian.

(a) *Knowledge.* Applicant must pass a written, oral, and practical examination demonstrating a practical and theoretical knowledge of the proper methods and procedures for making test and exhibition jumps, which shall include methods of leaving and clearing aircraft with relation to the speed and attitude thereof, emergency measures to be taken in the event of malfunction of the parachute during the opening and subsequent operation thereof, and the proper method of manipulation and control of the parachute during descent and landing.

(b) *Experience.* Applicant shall present proof satisfactory to the Administrator that he has satisfactorily accomplished at least 10 jumps without injury to himself or damage to his equipment.

(c) *Physical condition.* Applicant shall meet the physical standards of the third class prescribed in Part 29 of this subchapter.

§ 25.13 *Parachute instructor rating.* A special rating of parachute instructor will be entered on the Airman Rating Record of a certificated parachute technician who satisfactorily passes a written, oral, and practical examination demonstrating his ability to teach the processes and procedures which, in the opinion of the Administrator, are deemed necessary and appropriate for the construction, inspection, packing, maintenance, repair, and use of parachutes.

EXAMINATIONS AND TESTS

§ 25.16 *General.* All examinations and tests prescribed in §§ 25.17 through 25.19 shall be conducted at a time and place designated by the Administrator.

§ 25.17 *Standard of performance.* The passing grade of any theoretical examination shall be 70 percent. The prescribed practical examinations must be accomplished to the satisfaction of the Administrator.

§ 25.18 *Physical examination.* The appropriate physical examination prescribed for a parachute jumper rating shall be accomplished before any practical or theoretical test or examination will be given, and shall be completed within the 12 calendar months preceding such test.

§ 25.19 *Reexamination.* An applicant who has failed to:

(a) Accomplish successfully any prescribed theoretical examination may apply for reexamination at any time after the expiration of 30 days from the date of such failure; or

(b) Accomplish successfully any prescribed practical examination or test may apply for reexamination (1) after expiration of 30 days from the date of such failure, and (2) after he submits proof satisfactory to the Administrator that he has received adequate instruction by a certificated parachute technician holding a rating for the make and type of parachute on which he failed to demonstrate his ability.

ISSUANCE AND DURATION OF CERTIFICATES

§ 25.21 *General.* Application for a parachute technician certificate and rating shall be made upon the applicable form prescribed and furnished by the Administrator.

§ 25.22 *Duration.* A parachute technician certificate shall remain in effect unless it is suspended, or revoked, or until a general termination date for such certificate is fixed by the Board.

[Amdt. 25-4, 12 F. R. 4431]

§ 25.23 *Existing certificates.* Any person who, on January 21, 1943, possessed a currently effective mechanic certificate with parachute rigger rating may at any time prior to December 31, 1947, secure upon application a parachute technician certificate of:

(a) Parachute rigger grade with appropriate ratings; or

(b) A higher grade with appropriate ratings upon demonstrating to the Administrator that he is able to meet the standards currently prescribed in the regulations in this subchapter for the issuance of such grade and ratings.

[Amdt. 25-2, 11 F. R. 10419]

§ 25.24 *Temporary certificates.* The Administrator or his authorized representative may issue a temporary parachute technician certificate for a period of not to exceed 90 days, subject to the terms and conditions specified therein by the Administrator.

[Amdt. 25-4, 12 F. R. 4431]

§ 25.25 *Revocation.* No person whose parachute technician certificate has been revoked shall apply for or be issued a parachute technician certificate for a period of one year after the revocation, except as the order of revocation may otherwise provide.

REGULATIONS AND LIMITATIONS

§ 25.31 *General.* A certificated parachute technician shall not serve as such unless:

(a) He has in his possession his parachute technician certificate; and

(b) There is attached as part of his certificate the appropriate Airman Rating Record prescribed and issued by the Administrator setting forth such limitations as to type and make of parachute and such other limitations as the Administrator may prescribe.

[Amdt. 25-0, 8 F. R. 1332, as amended by Amdt. 25-1, 10 F. R. 12625]

§ 25.32 *Service limitations.* A certificated parachute technician shall not:

(a) Perform any act or serve in any manner in connection with his certificate which will adversely affect public safety;

(b) Pack any parachute which is not in condition for safe use;

(c) Serve otherwise than in accordance with the terms, limitations, and conditions of his certificate and rating record except as provided in §§ 25.32 through 25.46;

(d) Pack a parachute for use by any person other than himself; unless:

(1) Such parachute has been thoroughly dried and aired for a period of at least 12 hours for each 30 days since the time of its last packing; and

(2) Such parachute is packed in accordance with the approved method of the manufacturer and in a place where the minimum facilities prescribed in § 25.46 are available; and

(3) Within the preceding 30 days he has reviewed the manufacturer's instructions with respect to the packing of the particular type if more than 6 months have elapsed since he last packed a parachute of that make and type; and

(4) Within the preceding 30 days he has reviewed the manufacturer's instructions with respect to the packing of the particular type and has made at least 10 practice packings of that type if more than 12 months have elapsed since he last packed a parachute of the identical make and type;

(e) Make any modification, alteration, or major repair not specifically authorized in writing by the manufacturer of the parachute, or the Administrator, or make any substitution of materials or parts on any parachute, or in any way deviate from the manufacturer's approved procedures of packing any make or type of parachute.

[Amdt. 25-0, 8 F. R. 1332, as amended by Amdt. 25-1, 8 F. R. 10707]

§ 25.33 *Parachute rigger.* A parachute rigger shall not make any major repairs to parachutes unless he is under the supervision of a person deemed competent for the purpose by the Administrator.

§ 25.34 *Senior parachute rigger.* A senior parachute rigger shall not make any major repairs to parachutes except to those types for which he is rated unless he is under the supervision of a person deemed competent for the purpose by the Administrator; nor shall such repairs be made otherwise than in a manner which will restore the equipment to an airworthy condition.

§ 25.35 *Master of parachute maintenance.* A master of parachute maintenance shall not make any major repairs to parachutes except in a manner which will restore the equipment to an airworthy condition.

§ 25.36 *Parachute instructor.* A certificated parachute technician with a parachute instructor rating shall not permit any student under his supervision to make a training or exhibition parachute jump unless such student has been thoroughly instructed in the proper methods of making such jumps and the instructor is satisfied that the student has the theoretical knowledge prescribed in § 25.12 (a) and has passed the physical examination prescribed in § 25.12 (c).

§ 25.37 *Logbook*—(a) *Individual logbooks.* A certificated parachute technician shall keep a record of his parachute packing and jumping operations in a logbook, which shall be a bound record and contain accurate and legible entries in ink or indelible pencil.

(b) *Contents.* The logbook shall contain the date of packing or jumping, name and address of the owner, serial number of each parachute, its type and manufacturer, place where packed or jumped, the certificate number of the parachute technician, and a record of drop tests and repairs. Such logbook shall be presented to any authorized representative of the Administrator, or any State or municipal officer enforcing local regulations or laws involving Federal compliance, upon request and reasonable notice.

(c) *Master logbook.* A certificated parachute technician in charge of parachute maintenance operations, in which two or more certificated parachute technicians are engaged in the same parachute loft, shall be responsible for the maintenance of a master logbook which shall contain all of the information prescribed in § 25.37 (b).

§ 25.38 *Display of certificate.* A certificated parachute technician shall keep his certificate readily available when on duty and shall present it for inspection upon reasonable request by an authorized person or representative of the Administrator or Board or of any State or municipal officer enforcing local regulations or laws involving Federal compliance.

§ 25.39 *Inspection.* A applicant or holder of a parachute technician certificate upon reasonable request by any representative of the Administrator shall cooperate fully in any examination which may be made of him.

§ 25.40 *Surrender of certificate.* Upon the suspension, expiration, or revocation of any certificate, the holder shall upon request surrender such certificate to any duly authorized representatives of the Administrator.

§ 25.41 *Notice of defects.* A certificated parachute technician, upon refusal to pack any defective parachute, shall give notice thereof to the owner and forward a copy to the manufacturer of the parachute and to the Administrator. Such notice shall contain the owner's name and address, the manufacturer's name, serial number, date of manufacture, the type, material, and basic construction of the canopy, a statement containing the parachute's use and history, if known, and the reasons for refusing to pack the parachute.

§ 25.42 *Seal.* Each certificated parachute technician shall have a seal press of suitable design with an individual identifying marker assigned by the Administrator. Upon repacking any parachute, he shall seal the pack release with a thread of not more than 6 pounds tensile strength, and affix his seal in such a manner that it cannot interfere in any way with the prompt and proper functioning of the parachute, and shall make certain that the parachute cannot be opened without the destruction of the seal.

[Amdt. 25-0, 8 F. R. 1332, as amended by Amdt. 25-1, 8 F. R. 10707]

§ 25.43 *Parachute record.* A certificated parachute technician shall enter on the parachute packing record of each parachute packed by him the date and place of packing, his signature, and his certificate number.

§ 25.44 *Reports.* A certificated parachute technician shall transmit to the Administrator, annually, during the month of January, a report for the preceding 12-month period, setting forth the number and type of parachutes packed and such other pertinent data as the Administrator may require.

§ 25.45 *Transfer.* A parachute technician certificate is not transferable.

§ 25.46 *Minimum facilities.* Unless prior approval has been obtained from the Administrator, a certificated parachute technician shall not pack or repack any parachute or make any minor parachute repairs in a place other than where the following facilities for such operations are available:

(a) A suitable smooth-top table at least 3 by 40 feet in length;

(b) A suitable compartment where parachutes may be suspended for drying and airing;

(c) Packing tools and repair equipment suitable for the repacking and repair of the type of parachute involved; and

(d) Adequate housing facilities for such equipment.

Part 26—Air-Traffic Control-Tower Operator Certificates

AUTHORITY: §§ 26.1 to 26.37 issued sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 601, 602, 52 Stat. 1007, 1008; 49 U. S. C. 551, 552.

SOURCE: §§ 26.1 to 26.37 contained in Amendment 26-0, Civil Air Regulations, 7 F. R. 740, except as noted following sections affected.

QUALIFICATIONS FOR CERTIFICATE

§ 26.1 *General.* To be eligible for an air-traffic control-tower operator certificate an applicant shall be:

(a) At least 21 years of age; or, if serving as a member of the military services of the United States, at least 18 years of age: *Provided,* That certificates issued to members of the military services who are less than 21 years of age shall, until the holder thereof reaches the age of 21, be valid only when the holder is serving as a member of the military services in a control tower operated by such services.

(b) A person of good moral character;

(c) Able to read, write, and understand the English language and to speak the English language without any accent or impediment of speech which would interfere with two-way radio conversation;

(d) A citizen of the United States or of a foreign government which grants or has undertaken to grant reciprocal air-traffic control-tower operator privileges to citizens of the United States on equal terms and conditions with citizens of such foreign government.

[Amdt. 26-2, 8 F. R. 8527, as amended by Amdt. 26-1, 11 F. R. 7033, and Amdt. 26-4, 13 F. R. 4314]

§ 26.2 *Physical condition.* Applicant shall meet the physical standards of the Second Class prescribed in Part 29 of this subchapter.

[Amdt. 26-3, 7 F. R. 3924]

§ 26.3 *Knowledge.* An applicant must pass an examination in the following subjects: [1]

[1] Lists of source material covering the subject matter of these examinations can be obtained from any Regional Manager of the Civil Aeronautics Administration.

(a) Air traffic rules set forth in Part 60 of this subchapter;

(b) Airport traffic control procedures, and this part;

(c) Airway traffic control procedures;

(d) Radio frequencies and procedures used for airport traffic control;

(e) Use of radio aids to air navigation;

(f) The making of weather observations;

(g) Pertinent rules and regulations of the Federal Communications Commission. An applicant who presents satisfactory evidence that he possesses a restricted radiotelephone operator permit or higher grade of radiotelephone operator license issued by the Federal Communications Commission will not be required to take the examination prescribed in this paragraph.

QUALIFICATIONS FOR RATINGS

§ 26.6 *Character of ratings.* The holder of an air-traffic control-tower operator certificate (hereinafter referred to as "certificate") may receive a junior or senior rating, depending upon his qualifications to perform the duties of an air-traffic control-tower operator (hereafter referred to as "operator") at a particular airport.

§ 26.7 *Qualifications for junior rating.* An applicant must pass an examination on the following subjects:

(a) Local airport rules and characteristics of local air traffic of the airport for which the rating is sought;

(b) Local aircraft operations and such other aircraft operations as may affect conditions at the airport for which the rating is sought;

(c) Teletype symbols and weather sequences of the airways converging on the airport and other pertinent data regarding meteorological reports available within a circular area of a radius of 125 miles measured from the airport for which the rating is sought.

(d) Any other subject or subjects in which the Administrator may deem an examination necessary. The applicant will be given adequate notice of the subject of the examination.

[Amdt. 26-0, 7 F. R. 740, as amended by Amdt. 26-5, 14 F. R. 2195]

§ 26.8 *Qualifications for senior rating*—(a) *Knowledge.* An applicant must pass an examination in the subjects required for a junior rating and, in addition, the following subjects:

(1) Air navigation facilities within a radius of 200 miles of the airport for which the rating is sought;

(2) Airway traffic control procedures in the area in which the airport for which the rating is sought is located;

(3) Instrument approach and departure procedures at the airport for which the rating is sought;

(4) Any other subject or subjects in which the Administrator may deem an examination necessary.

The applicant will be given adequate notice of the subject of the examination.

(b) *Experience.* An applicant must have performed satisfactory service:

(1) As an operator with a senior rating for at least 6 months; or

(2) As an operator with a junior rating at the airport for which the rating is sought for the 6 months immediately preceding application; or

(3) As an air-traffic control trainee in Federal service for at least 6 months; or

(4) For 1 year of the 2 years immediately preceding application as:

(i) An operator with a junior rating at an airport other than that at which the rating is sought; or

(ii) An operator at a landing area under military or naval jurisdiction.

(c) *Other requirements.* The applicant must demonstrate his ability to supervise and manage all activities of the airport control tower or airport control station, which shall at least include the preparation of such reports as may be required from time to time by the airport manager or the Administrator.

EXAMINATIONS

§ 26.12 *General.* The prescribed examinations will be conducted by representatives of the Administrator at a designated time and place.

[Amdt. 26-1, 10 F. R. 8528]

§ 26.13 *Physical examinations.* (a) The prescribed physical requirements must be met before any practical or theoretical examination will be given and must be completed within the 12 months immediately preceding application for a certificate.

(b) In lieu of a physical examination conducted by an authorized medical examiner of the Administrator, a form acceptable to the Administrator, signed by a medical officer on duty with the Army, Navy, Marine Corps, or Coast Guard who is authorized to conduct physical examinations for flying stating that the applicant is an active member of his service and has met within the preceding 12 months the physical requirements prescribed by § 26.2.

[Amdt. 26-0, 7 F. R. 740 as amended by Amdt. 26-3, 7 F. R. 3924]

§ 26.14 *Reexamination.* An applicant who has failed to pass any examination may apply for reexamination after the expiration of 30 days from the date of his failure.

ISSUANCE AND EXPIRATION OF CERTIFICATES

§ 26.18 *Duration.* An air-traffic control-tower operator certificate will continue in effect until suspended or revoked or a termination date is set by the Board.

[Amdt. 26-1, 10 F. R. 8528]

§ 26.19 *Temporary certificates.* The Administrator or his authorized representative may issue a temporary air-traffic control-tower operator certificate for a period of not to exceed 90 days, subject to the terms and conditions specified therein by the Administrator.

[Amdt. 26-2, 12 F. R. 4432, 4713]

REGULATIONS

§ 26.25 *Rating record.* A certificated operator shall not serve as such unless there is attached to his certificate the appropriate rating record prescribed and issued by the Administrator, nor serve otherwise than in accordance with the limitations prescribed by the Administrator in his certificate or rating record.[1]

§ 26.26 *Exercise of authority.* A certificated air-traffic control-tower operator shall control traffic in accordance with the procedures and practices prescribed by the Administrator to provide for the safe, orderly, and expeditious flow of air traffic and in accordance with the following requirements:

(a) When weather conditions are equal to or better than the basic minimums prescribed for VFR flight by Part 60 of this subchapter, air traffic may be controlled by an operator with either a junior or senior rating for the airport involved: *Provided,* That where the Administrator finds the volume or character of the air traffic, the type and equipment of aircraft utilizing the airport, or the airport facilities require that an operator with a junior rating be supervised, he may require all air traffic at such airport to be controlled under the supervision of an operator with a senior rating.

(b) When weather conditions are below the basic minimums prescribed for VFR flight by Part 60 of this subchapter, air traffic shall be controlled by an operator with senior rating, and such operator shall not issue an air traffic clearance for flight without prior authorization from the appropriate air traffic control center.

(c) In an emergency an operator with a senior rating may delegate his authority to an operator with a junior rating.

[Amdt. 26-3, 13 F. R. 473]

General.

§ 26.26-1 *Definitions (CAA rules which apply to § 26.26).* The following definitions apply to §§ 26.26-2 through 26.26-104:

(a) Agency: The United States Air Force (AF), the United States Navy, the United States Coast Guard, or the Civil Aeronautics Administration.

(b) Airport: A defined area on land or water, including any buildings and installations, normally used for the takeoff and landing of aircraft.

(c) Airport traffic: Aircraft operating on and in the vicinity of an airport and other traffic operating on the movement area.

(d) Air route traffic control area (see Control area).

(e) Air route traffic control center: A facility established by competent authority to provide adequate supervision of air traffic within a specified control area.

(f) Air traffic: Aircraft in operation anywhere in the airspace and on that area of an airport normally used for the movement of aircraft.

(g) Air traffic clearance: Authorization by air traffic control, for the purpose of preventing collision between known aircraft, for an aircraft to proceed under specified traffic conditions within a control zone or control area.

(h) Air traffic control: A service established by competent authority to pro-

[1] The rating record is a sheet which will be attached to all certificates when they are issued and will prescribe the airports at which the holder is authorized to serve and the class of rating held.

mote the safe, orderly, and expeditious flow of air traffic.

(i) Air traffic controller: A person responsible for providing air traffic control service.

(j) Airway: A path through the navigable airspace designated by the Administrator, suitable for interstate, overseas, or foreign air commerce.

(k) Alternate airport: An airport specified in the flight plan to which a flight may proceed when a landing at the point of first intended landing becomes inadvisable.

(l) Approach control: A service established to control IFR flights arriving at, departing from, and operating in the vicinity of airports by means of direct and instantaneous communication between approach control personnel and all aircraft operating under their control.

(m) Approach sequence: Two or more aircraft awaiting an approach clearance.

(n) Arrival: An arriving aircraft.

(o) ATC: Air Traffic Control.

(p) CAA: Civil Aeronautics Administration.

(q) Center: An air route traffic control center.

(r) Clearance: An air traffic clearance.

(s) Clearance limit: The point to which an aircraft is cleared.

(t) Competent authority: A representative authorized to act for an agency.

(u) Control area: An airspace of defined dimensions, designated by the Administrator, extending upwards from an altitude of 700 feet above the surface, within which air traffic control is exercised.

(v) Control tower: A facility to provide for supervision of airport air traffic.

(w) Control zone: An airspace of defined dimensions, designated by the Administrator, extending upwards from the surface, to include one or more airports, and within which rules additional to those governing flight in control areas apply for the protection of air traffic.

(x) Cruising altitude: A constant altimeter indication, in relation to sea level, maintained during a flight or portion thereof.

(y) Departure: A departing aircraft.

(z) Expected approach time: The time at which it is expected that an arrival will be cleared to commence its approach procedure preparatory to landing.

(aa) Flight plan: Specified information filed either verbally or in writing with Air Traffic Control, relative to the intended flight of an aircraft.

(bb) Holding point: A specified location, identified by visual or other means, in the vicinity of which the position of an aircraft in flight is maintained in accordance with Air Traffic Control instructions.

(cc) ICAO: International Civil Aviation Organization.

(dd) IFR: The symbol used to designate instrument flight rules.

(ee) IFR conditions: Weather conditions below the minimum prescribed for flights under VFR.

(ff) Movement area: The part of an airport reserved for the taking off, landing, and maneuvering of aircraft.

(gg) Reporting point: A geographical location in relation to which the position of aircraft is reported.

(hh) Rescue coordination center: A center which initiates, coordinates, and terminates search and rescue within an assigned area.

(ii) Rescue control center: A unit subordinate to a safety center established to direct search and rescue activities.

(jj) Safety center: A coordinated activity consisting of an air route traffic control center and a rescue coordination center.

(kk) Separation: A specified longitudinal, vertical, or lateral separation between two or more aircraft in flight.

(ll) Separation standards: The minimum longitudinal, vertical, or lateral separation provided IFR traffic.

(mm) State: Any nation of the world (international usage).

(nn) Take-off clearance: Authorization by an airport traffic control tower for an aircraft to take off.

(oo) Tower: An airport traffic control tower.

(pp) VFR: The symbol used to designate visual flight rules.

(qq) VFR conditions: Weather conditions equal to or above the minimum prescribed for flights under VFR.

(rr) VFR traffic: Aircraft operating solely in accordance with VFR.

[Supp. 1, 14 F. R. 3327]

§ 26.26–2 *Scope (CAA rules which apply to § 26.26).* (a) Air Traffic Control procedures contained in §§ 26.26–1 through 26.26–104 shall be uniformly applied in all air route traffic control centers and airport traffic control towers operated by the United States Air Force, United States Navy, and Civil Aeronautics Administration, and by other civil air traffic control agencies.[1]

(b) Where military necessity requires a reduction in separation standards, specific request for such deviation must be obtained in writing from the competent authority. These lower standards will apply only between aircraft directly under the jurisdiction of the competent authority making such request, and shall be fully covered by operations letters issued by the center or tower concerned.

(c) Control of instrument flight rule air traffic is based on the provisions of Part 60 of this chapter. The issuance of traffic clearances by centers and towers constitutes authority for the pilot to proceed only insofar as known air traffic is concerned.

(d) The basic plan for the control of air traffic involves the establishment of air route traffic control centers at strategic locations. To expedite the movement of aircraft arriving and departing at certain airports served by airport traffic control towers established by competent authority, the control of IFR traffic as well as VFR traffic is delegated to tower personnel.

(e) Where a military agency has jurisdiction over a control area, supervision of the center or tower(s) will be determined by agreement among all agencies concerned.

(f) Under certain conditions it may not be desirable to establish a control area due to limited air traffic or absence of adequate navigational facilities. In this event, a suitable control zone may be established wherein the control of traffic will be the responsibility of a tower.

[Supp. 1, 14 F. R. 3328]

§ 26.26–3 *Application of control procedures (CAA rules which apply to § 26.26).* (a) The control of instrument flight rule air traffic shall be applied in all control areas and control zones. Control areas and control zones will be designated by the appropriate authority.

(b) For the proper coordination and control of air traffic, it will be necessary under certain conditions to establish control areas over international waters as well as territories of other states, and to place such areas under the jurisdiction of United States air route traffic control centers. The boundaries of control areas and control zones outside the continental limits of the United States will normally be designated by the appropriate authorities by mutual agreement between the states concerned under the auspices of ICAO.

[Supp. 1, 14 F. R. 3328]

§ 26.26–4 *Air traffic control service (CAA rules which apply to § 26.26)*—(a) *Objective.* The primary objective of the air traffic control service shall be to promote the safe, orderly, and expeditious movement of air traffic. This shall include:

(1) Preventing collisions between aircraft and between aircraft and obstructions on the movement area.

(2) Expediting and maintaining an orderly flow of air traffic.

(3) Assisting the person in command of an aircraft by providing such advice and information as may be useful for the safe and efficient conduct of a flight.

(4) Notifying appropriate organizations regarding aircraft known to be or believed to be in need of search and rescue aid, and assisting such organizations as required.

[Supp. 1, 14 F. R. 3328]

§ 26.26–5 *Types of service (CAA rules which apply to § 26.26)*—(a) *Area traffic control.* Area traffic control is administered from an air traffic control center and provides air traffic control service for air traffic operating within a specified control area.

(b) *Airport traffic control.* Airport traffic control is established to provide adequate supervision of all traffic on the movement area and aircraft flying in visual reference to the ground in the immediate vicinity of an airport.

(1) Airport traffic control may operate either within the boundaries of a control area or at locations not supervised by a center.

(c) *Approach control.* Approach control is a service established to provide separation of air traffic arriving at, departing from, or operating in the vicinity of an airport by means of direct and instantaneous communication between approach control personnel and all aircraft under their control.

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[1] This includes all air traffic control tower operators certificated by the Civil Aeronautics Administration.

(1) Approach control personnel are governed by clearances received from the center with regard to coordination of control.

(d) *Flight assistance service.* Flight assistance service is provided to assist persons in command of aircraft by supplying information concerning known flight conditions, and to initiate search and rescue action for aircraft overdue at point of intended landing. (See Civil Aeronautics Administration and Weather Bureau Manual, "Standard Procedures for Flight Assistance Service.")

[Supp. 1, 14 F. R. 3328]

§ 26.26-6 *Allocation of responsibility (CAA rules which apply to § 26.26)*—(a) *Towers and centers.* (1) Visual flight rules: The only separation of air traffic not operating on an IFR flight plan in weather conditions equal to or better than the VFR minimums shall be that effected by a tower.

(2) Authorizing VFR operations in the control zone below VFR conditions where no tower is located: Authorization, by air route traffic control centers, of VFR operations below VFR conditions in control zones shall be in accordance with the following:

(i) When IFR traffic conditions permit, an airport operator (or his representative) may be authorized to permit local VFR operations, such as landings and take-offs, when the weather is below the VFR condition specified in Part 60 of this chapter. The following phraseology shall be used in this connection:

"Local VFR operations in the immediate vicinity of (name of) airport are authorized until (time)." (Any special instructions, such as the maximum altitude which may be used, should be added.)

(a) The airport operator is responsible for the establishment of adequate traffic patterns for such operation.

(ii) Requests for approval of departure from or entry into a control zone shall be handled individually. In each case, standard separation (§ 26.50-21) shall be effected between such operations and all IFR traffic, as well as other operations of the same nature.

"ATC clears (aircraft identification) out of to enter control zone (number of) miles (direction) of (airport); cruise not above (altitude) while in control zone."

(iii) Standard separation (§ 26.26-21) shall be provided between all VFR operations operating in less than VFR conditions and all IFR flights operating on a traffic clearance.

(3) Instrument flight rules: The control of IFR traffic shall be effected by centers and those towers controlling IFR traffic (approach control) as follows:

(i) The center shall clear aircraft to the holding point, including holding information and expected approach time in such clearances. The holding point shall normally be a reporting point on the approach course from which an approach to the airport will be started. Approach control shall assume control of the aircraft upon arrival of the aircraft over the holding point, provided aircraft have been released to approach control.

(ii) The center shall provide separation between all aircraft operating within a control area except that:

(a) Approach control shall maintain separation between those aircraft released to approach control upon arrival of such aircraft over the holding point and during approach to the airport.

(b) Approach control shall provide separation between departing aircraft and aircraft on an approach from the holding point.

(4) The control of more than one approach sequence may be effected by approach control provided the division of control between the center and approach control is defined in operations letters approved by competent authority and is basically consistent with the above procedures.

(5) If it is considered essential, due to the position of holding points or for other reasons, to define an area wherein the control of traffic will be effected by approach control, the boundaries of such area and the division of control between the center and approach control shall be contained in operations letters approved by competent authority.

[Supp. 1, 14 F. R. 3328]

Procedures for the control of instrument flight rule traffic.

§ 26.26-21 *Separation standards (CAA rules which apply to § 26.26)*—(a) *General.* Longitudinal, vertical, or lateral separation shall be provided all aircraft operating on IFR traffic clearances (unless the cruising altitude "at least 500 on top" has been authorized), except that a VFR restriction may be applied to climb or descent and shall be applied when longitudinal, vertical, or lateral separation is not provided during climb or descent. These standards need not be applied in a control zone if:

(1) In the opinion of the airport traffic controllers adequate separation can be provided by the tower when each aircraft is continuously visible to the tower controller; or

(2) Each aircraft is continuously visible to pilots of other aircraft concerned and the pilots thereof can maintain their own separation and so advise.

[Supp. 1, 14 F. R. 3329]

§ 26.26-22 *Longitudinal separation (CAA rules which apply to § 26.26)*—(a) *Longitudinal separation.* The longitudinal spacing of aircraft at the same altitude by a minimum distance expressed in units of time, so that after one aircraft passes over a specified position the next succeeding aircraft at the same altitude will not arrive over the same position within less than the minimum number of minutes.

(b) *Minimums.*

(1) Aircraft flying on the same or converging courses:

(i) Ten minutes if radio facilities permit frequent determination of position and speed; otherwise 15 minutes.

(ii) Five minutes if a preceding aircraft has filed an air speed at least 25 miles greater than that of a succeeding aircraft.

(2) Aircraft flying on crossing courses:

(i) Ten minutes if radio facilities permit frequent determination of position and speed; otherwise 15 minutes.

(c) *Altitude change; same-direction traffic.* When lateral separation is not provided and an aircraft will pass through the altitude of another aircraft, the following longitudinal separation shall be provided:

(1) Five minutes at the time altitude levels are crossed, and provided that such separation is authorized only when:

(i) The vertical separation at the time of commencement of change is 2,000 feet or less; and

(ii) A leading aircraft is being cleared for descent through the altitude of a following aircraft, or a following aircraft is being cleared for climb through the altitude of a leading aircraft; and

(iii) The altitude change is commenced within 10 minutes after the time the second aircraft has reported over a reporting point.

(d) *Altitude change; opposite-direction traffic.* (1) Where lateral separation is provided, longitudinal separation is not required when an aircraft is to pass through the altitude level of another aircraft.

(i) Essential traffic information shall be issued.

(ii) The aircraft changing altitude level shall be cleared to climb/descend well to the right of the course.

(2) Where lateral separation is not provided, vertical separation shall be provided for at least 10 minutes prior to and after the time the aircraft are estimated to pass, or are estimated to have passed.

(i) If reports are received that aircraft have passed each other, this minimum need not apply.

(3) Where opposite-direction traffic is regularly provided vertical separation because of inadequate radio navigation facilities or other reasons, the required procedures shall be contained in operations letters approved by competent authority.

(e) *Application.* Longitudinal separation shall be established by requiring aircraft to depart at a specified time, to lose time to arrive over a geographical location at a specified time, or to hold at a geographical location until a specified time. As an alternative procedure, or in emergencies, aircraft may be required to reverse course.

(1) Pilots in direct radio communication with each other and operating with the aid of navigation facilities which provide frequent determinations of position and speed may, with their concurrence, be requested to maintain minimum longitudinal separation between their aircraft.

[Supp. 1, 14 F. R. 3329]

§ 26.26-23 *Vertical separation (CAA rules which apply to § 26.26)*—(a) *Vertical separation.* The vertical spacing of aircraft.

(b) *Minimum.* 1,000 feet, except as provided for all operators on long transoceanic routes where a reduction in altitude separation is necessary due to the relatively few cruising altitude levels available which permit proper fuel economy below altitudes which require continuous use of oxygen equipment.

(1) No separation is required for en route traffic operating "at least 500 feet on top" if frequent pilot reports indicate a generally unlimited ceiling on top and a flight visibility of at least 3 miles. During the hours of daylight, holding aircraft operating under these conditions will require no separation.

[Supp. 1, 14 F. R. 3329]

§ 26.26-24 *Lateral separation (CAA rules which apply to § 26.26)*—(a) *Lateral separation.* The lateral spacing of aircraft at the same altitude by requiring operation on different routes or in different geographical locations as determined by visual observation or by use of radio navigational facilities.

(b) *Minimums.* All of these types of separation must be constant or increasing:

(1) *Right-side separation.* Opposite-direction traffic flying on opposite sides of a well-defined track which can be accurately determined by radio.

(2) *Quadrant or sector separation.* Flight in different quadrants or sectors of the same radio navigation facility.

(3) *Geographical separation.* Separation positively indicated by position reports over different geographical locations as determined visually or by reference to a radio facility.

(4) *Course separation.* Where courses diverge more than 45°.

(5) *Track separation.* Where aircraft are assigned different specified tracks which can be accurately determined by radio.

(c) *Right-side separation.* Aircraft shall be considered as occupying all space from the on-course signal to the right edge of the airway. (Part 60 of this chapter requires only that a pilot remain to the right of the center line of an airway.)

(1) Where radio navigation facilities are not adequate for right-side separation, opposite-direction traffic shall be separated vertically. Right-side separation shall apply to aircraft on such courses when it has been definitely determined that the aircraft are, and will remain, on opposite sides of the same course of a specified radio facility during such time as lateral separation is required. Right-side separation should not be used in the immediate vicinity of a radio range station due to the narrowness of course signals.

(2) In emergencies, same- or opposite-direction traffic may be separated by requiring flight on opposite sides of, and well off, a well-defined track which can be accurately determined by radio.

[Supp. 1, 14 F. R. 3329]

§ 26.26-25 *Altitude assignment (CAA rules which apply to § 26.26)*—(a) *Priority.* An aircraft at an altitude shall normally have priority over other aircraft desiring that altitude. When two or more aircraft are at the same altitude, the preceding aircraft shall normally have priority.

(b) *Minimum altitudes.* A controller shall not assign or authorize en route altitudes below the established minimum IFR altitude for an on-airway route to be flown within his control area and for entering the control area of an adjacent center. A controller shall not assign or authorize en route altitudes below the established minimum IFR altitude for a direct route (off-airway). The minimum IFR altitudes established by the Administrator shall be used. If a minimum IFR altitude for a direct route has not been established, a controller shall not assign or authorize an altitude below the minimum IFR altitude established for that portion of the route which lies within his control area or that portion of an adjacent center's control area which the flight will first enter or cross.

(c) *Application.* When an aircraft reports vacating an altitude, the vacated level may be assigned to another aircraft, except that, if severe turbulence is known to exist, the first aircraft must have reported at another level before such assignment is made.

(1) Pilots in direct communication with each other may, with their concurrence, be requested to maintain a specified vertical separation between their aircraft during descent or climb.

(d) *Cruising altitudes.* Insofar as practicable, cruising altitudes of aircraft flying to the same destination shall be assigned in a manner that will be correct for an approach sequence at destination.

(e) *On-top altitude.* "At least 500 feet on top" may be assigned for flight above a cloud, haze, smoke, or other formation if the flight visibility is at least 3 miles, provided the ceiling is generally unlimited above the formation. A known definite top must exist and the aircraft shall be advised of its reported height when this clearance is issued. Caution shall be exercised in assigning on-top altitudes to long range flights operating over areas where the height of the formation is not known.

(f) *Altitude changes.* When necessary, an aircraft may be requested to change altitude at a specified time or place.

[Supp. 1, 14 F. R. 3330]

§ 26.26-26 *Holding aircraft (CAA rules which apply to § 26.26)*—(a) *Holding aircraft.* Aircraft shall be held at a designated holding point to provide minimum separation between aircraft which are awaiting their turn to land and/or to provide longitudinal separation from other aircraft. When aircraft are held at a point en route and no expected approach clearance time is issued the holding clearance shall contain a time limit, using the phrase "Expect further clearance at (time)."

(b) *Weather below landing minimums.* When the weather is below the landing minimums of an aircraft in approach sequence, the following action may be taken:

(1) An approach clearance shall be issued to the number one aircraft in the holding sequence. If the pilot then advises he desires to hold and await improvement in the weather, such action will be approved unless the reported weather is above the minimums for other aircraft in the approach sequence.

(2) In the latter case, the approach clearance shall be canceled and the number one aircraft shall be removed from its position in the holding sequence. The aircraft shall be cleared to an adjacent fix for further holding awaiting weather change or redispatching, or given appropriate climbing clearance to place it at the top of the approach sequence, in order that the other holding aircraft may be permitted to land. The aircraft operator (if any) shall be advised of the action taken immediately after the clearance is issued, if practicable.

(3) Approach controllers shall, before taking the action outlined in subparagraph (2) of this paragraph, coordinate the rerouting of the flight with the center in order to avoid confliction with traffic under center control.

(c) Nondirectional radio stations, compass locators, and fan type marker stations shall be utilized as holding points only if the facility is associated with a course of a radio range station or ILS localizer by means of which the holding pattern may be accurately established, unless the aircraft is equipped with a radio compass or other equipment which may be utilized to definitely establish the desired holding pattern.

(1) Nondirectional radio stations, compass locators, fan type marker stations, and any other type of facility which is not constantly monitored shall not be utilized for control purposes if failure of the pilot definitely to identify the facility would result in inadequate separation or endanger the safety of aircraft.

(d) *Long-range flights.* Caution must be exercised when issuing holding clearances to long-range flights. Consideration should be given to the aircraft's fuel reserve and to the fact that pilots of such flights are subject to a greater degree of fatigue than pilots of short-range flights, and it may not be advisable, therefore, to require long-range flights to hold for an extended period.

(e) *Standard holding flight path.* The standard holding flight path of an aircraft is to follow the specified course inbound to the holding fix, make a 180-degree standard rate (3° per second) turn to the right, fly a parallel straight course out-bound from the holding fix for 2 minutes, make another 180° standard rate turn to the right, and again follow the specified course in-bound.

(1) *Deviation.* A pilot's request to deviate from the standard holding flight path may be approved if known traffic conditions permit.

(f) *Vertical separation from other traffic.* When aircraft are being held in flight, the appropriate vertical separation minimums shall be provided between holding aircraft and en route aircraft while such en route aircraft are within 5 minutes' flying time of the holding aircraft's flight path.

[Supp. 1, 14 F. R. 3330]

§ 26.26-27 *Control procedures (CAA rules which apply to § 26.26)*—(a) *General.* If a position report is not received within a reasonable length of time after the estimated time over a reporting point, subsequent control shall not be based on the assumption that the estimated time is accurate. Action shall be taken to obtain the report no later than

5 minutes after the estimated time over the reporting point, when the report has any bearing on the control of aircraft.

(b) *Flight conditions.* Pilots may be requested to forward specific information on flight conditions which might be useful to Air Traffic Control.

(c) *Weather report.* Where necessary, specific flights may be requested to forward a complete weather report with each scheduled position report.

(d) *Alternate procedures.* When an IFR traffic clearance authorizes VFR operation during climb or descent, alternate clearance shall be issued if there is a possibility that VFR flight may become impracticable.

(e) *Center coordination.* Centers shall forward appropriate flight plan data and control information pertinent to all instrument flights from center to center as the flight progresses except that flight plans on flights specifying VFR for the first portion of the route and IFR for a latter portion, beginning in another control area, shall be forwarded by the flight plan station direct to the center in whose area IFR flight will be commenced, via Service "B" (air-carrier communications channels, in the case of scheduled air-carrier aircraft).

(1) The appropriate flight plan data and control information shall normally be transmitted via Service "F" and in sufficient time to permit reception of the data by the adjacent center not later than 30 minutes prior to the time the flight is estimated to enter the adjacent center's area. If, in the opinion of the controller on duty, Service "F" facilities are inadquate, the data shall be transmitted in the form of a control message via Service "B". The control message shall be transmitted by the originating center to the associated communication station via Service "F". The communication station associated with the center to whom the control message is addressed will forward the message to the appropriate center sector via Service "F".

(2) The following data shall be forwarded from center to center as an IFR flight progresses:

(i) Flight identification and type of aircraft.

(ii) Estimate and altitude over the last fix within the control area and the altitude of entry into the adjacent center's area if different from the altitude over the last fix.

(iii) Actual ground speed, if determined; or, estimated ground speed (the estimated ground speed used in calculating the estimate over the last fix).

(iv) Point of departure; the remaining portion of the route of flight, as specified in the original or amended clearance, and the point of first intended landing.

(v) The estimated time of arrival as specified in the flight plan (time of departure plus elapsed time) based on the time zone of the departure point.

(*a*) The information contained in this subdivision (v) shall not be forwarded on scheduled air-carrier or military aircraft. If required, the center controlling the point of destination may secure the estimated time of arrival from the air-carrier operator, the appropriate flight service center, or the flight plan station serving the point of departure. Information concerning any other information specified in the flight plan may be similarly obtained.

(vi) Clearance information:

(*a*) Clearance limit, if other than the airport of destination.

(*b*) Special information, if issued.

(vii) Altitude(s) requested by the pilot (as specified in the flight plan or subsequently requested en route).

(*a*) The information contained in this subdivision (vii) need not be transmitted if agreements between adjacent centers permit deletion of this information. If information concerning the altitudes requested by the pilot is deleted by agreement between any two centers along the route of flight, centers controlling subsequent portions of the route shall not request the information.

(3) When 5-minute longitudinal separation in accordance with § 26.26–22 (b) (1) (ii) is utilized and less than the minimum longitudinal separation for the route will exist at the time the aircraft enter the area adjacent to the area of departure, the adjacent center shall be advised of the separation being used.

(4) Whenever it is necessary to issue clearances requiring a change in the operation of an aircraft within another center's control area, before such aircraft enters the control area of the center issuing the clearances such instruction shall be routed through the center concerned for approval and transmission to the aircraft.

[Supp. 1, 14 F. R. 3330]

§ 26.26–28 *Control of long-range flights (CAA rules which apply to § 26.26)*—(a) *General.* Commensurate with the orderly flow of long-range traffic, every effort should be made to permit departing aircraft to proceed on course with as few turns or other maneuvers as possible. Heavy take-off loads make the early portion of flight very critical, and this factor should be considered in the control of departing aircraft. When it is determined beforehand that it will be necessary to delay the departure of a flight, the operator thereof will be notified as soon as possible to avoid the necessity of holding aircraft on the airport with the engines running for extended periods of time.

(b) *Position reporting.* Within the limits of the available communications facilities, the minimum number of position reports necessary for adequate control should be required. Due to extreme unreliability, dead reckoning position reports are unsuitable for normal air traffic control purposes. Control should be based only on celestial, radio, radar, or Loran fixes or on a fix obtained by a combination of two or more of these methods. Any limitation imposed by delays inherent in the available communications system must be considered in the issuance of clearances. Control shall be based on the assumption that a subsequent position report will be promptly received.

[Supp. 1, 14 F. R. 3331]

§ 26.26–29 *Departures and arrivals (CAA rules which apply to § 26.26).* The following restrictions are in addition to separation minimums specified in §§ 26.26–22, 26.26–23, and 26.26–24:

(a) *General.* When control is based thereon, the clearance shall specify direction of take-off and turn after take-off, track to be made good before proceeding on desired course, altitude to maintain before continuing climb to assigned altitude, time or point at which altitude change shall be made, and any other necessary maneuver.

(b) *Minimum time separation; take-off.* (1) Five-minute separation at the time altitude levels are crossed if a departure will be flown through the altitude level of a preceding departure and both departures propose to follow the same course. Action must be taken to insure that the 5-minute separation will be maintained or increased when altitude levels are crossed.

(2) Three-minute separation at the time courses diverge if aircraft propose to fly the same course immediately after take-off and then follow different courses, provided aircraft will follow diverging courses within 5 minutes after take-off. Action must be taken to insure that the 3-minute separation will be maintained or increased during the period the aircraft are following the same course.

(3) One-minute separation if aircraft propose to fly different courses and lateral separation is provided immediately after take-off. This minimum may be reduced when aircraft are using parallel runways provided operations letters covering the procedure have been approved by competent authority.

(c) *Direction of take-offs.* Departures may be expedited by suggesting a take-off direction when the wind velocity does not exceed 10 miles per hour. It is the pilot's responsibility to decide between making such take-off or waiting for normal take-off in a preferred direction.

(d) *VFR departure.* Departures may be cleared to maintain VFR until a specified time or to a specified location if reports indicate that aircraft can continue with 3 miles' visibility and can remain 500 feet vertically and 2,000 feet horizontally from all clouds.[2]

(e) *Special reports.* Arrivals may be requested to report when leaving or passing a reporting point, starting procedure turn on final approach, or other information required by the controller to expedite departures.

(f) *Take-off limitations.* When take-off clearance is based on the position of an arrival the following shall apply:

(1) If the arrival will make a complete instrument approach (initial and final approach) a departure—

(i) May take off in any direction until arrival has started procedure turn on final approach;

(ii) May take off in a direction which is different by at least 45° from the reciprocal of the direction of approach after arrival has started procedure turn leading to final approach, provided that

[2] Caution should be exercised when using this procedure whenever a ceiling exists in that it may require the pilot to violate terrain clearance regulations in order to maintain 500 feet vertical separation from clouds.

the take-off will be made at least 3 minutes before the arrival is estimated over the airport.

(2) If the arrival will make a straight-in approach (final approach only) a departure—

(i) May take off in any direction until 5 minutes before the arrival is estimated over the airport;

(ii) May take off in a direction which is different by at least 45° from the reciprocal of the direction of approach of the arrival until 3 minutes before the arrival is estimated over the airport.

(3) The above take-off limitations need not apply when, at the discretion of an approach controller, take-off is authorized under the following conditions:

(i) When the arrival is sighted by the controller;

(ii) When the arrival, making a ground contact approach, reports over a visual reporting point not less than 2 minutes from the airport, and reasonable assurance exists that the approach can be continued by visual reference to the ground; or

(iii) When the arrival, in radar contact and positively identified, is observed to be not less than 3 miles from the airport.

(g) *Approach clearance.* Except at locations where approach control is in operation, succeeding aircraft shall not be authorized to commence final descent for a landing until the first aircraft is in communication with and is sighted by tower personnel and reasonable assurance exists that normal landing can be accomplished.

[Supp. 1, 14 F. R. 3331]

§ 26.26–30 *Expected approach time (CAA rules which apply to § 26.26)*—(a) *Expected approach time.* The time at which it is expected that an arrival will be cleared to commence its approach procedure preparatory to landing.

(b) *Issuance to aircraft.* Expected approach time shall be issued and currently revised. Approach control shall issue revised expected approach time to aircraft under their jurisdiction.

(1) If the aircraft is within the control area of intended landing when determination of delay is made, the expected approach time shall be issued as soon as practicable. If aircraft approaching the area are expected to be delayed 1 hour or more, the expected approach time shall be issued immediately through the adjacent center.

(c) *Excessive delays.* ATC should advise aircraft operators and Military Flight Service when excessive delays to arrivals and departures are anticipated. If departures are delayed to avoid excessive holding at destination, ATC shall normally clear such flights in the order in which the flight plans are filed.

[Supp. 1, 14 F. R. 3331]

§ 26.26–31 *Approach sequence (CAA rules which apply to § 26.26)*—(a) *Approach sequence.* An approach sequence is established as follows:

(b) *Priority.* The first aircraft estimated to arrive over the point from which approaches are commenced will normally be the first aircraft to approach. Other aircraft will normally have priority in the order of their estimated arrivals over such point.

(c) *Altitude assignment.* Altitudes at holding points shall be assigned in a manner that will facilitate clearing each aircraft to approach in its proper priority. Normally the first aircraft to arrive over a holding point should be at the lowest altitude, with following aircraft at successively higher altitudes.

[Supp. 1, 14 F. R. 3332]

§ 26.26–32 *Approaches (CAA rules which apply to § 26.26)*—(a) *Approaches.* Specific approaches may be required to expedite traffic.

(b) *Instrument approach.* The initial approach altitude, the point (in minutes or miles from the appropriate reporting point) at which procedure turn will be started, the procedure turn altitude, and the final approach course shall be specified. The missed-approach procedure shall be specified when deemed necessary.

(1) The provisions of this paragraph need not be applied where a standard instrument approach procedure is established and pilots are known to be familiar with the procedure, including the missed-approach procedure as specified in an air-carrier company manual or an official tabulation of instrument approach procedures.

(2) When the reported ceiling is below the initial approach altitude authorized over the radio navigation facility at point of intended let-down, the reported ceiling, visibility, and altimeter setting shall be transmitted in the approach clearance to other than air-carrier aircraft. The center shall effect transmission by requesting the communications station to "give current weather." At locations provided with approach control, this information shall be transmitted by the tower to all aircraft, including air carrier, on the initial transmission to such aircraft. Subsequent changes shall be forwarded to the aircraft as they become available.

(3) If visual reference to the ground is established before completion of the approach procedure, it is expected that the entire procedure will nevertheless be executed unless the pilot requests and is granted clearance to proceed directly to the airport.

(c) *Contact approach.* An aircraft may be authorized to execute a contact approach if requested by the pilot. Standard separation shall be effected between aircraft so cleared and between such aircraft and other arriving or departing aircraft.

(d) *No specified approach.* Traffic permitting, a specified approach shall not be required.

[Supp. 1, 14 F. R. 3332]

§ 26.26–33 *Coordination between centers and towers (CAA rules which apply to § 26.26)*—(a) *General.* Coordination between centers and towers will be effected as follows:

(b) *Authority.* Towers will observe such instructions as are issued by the appropriate center.

(c) *Towers providing approach control service.* A tower may issue clearances to any aircraft released to tower control without reference to the center, except that when an approach has been missed the center will be advised immediately and subsequent action coordinated between the center and tower.

(1) *Clearing departures.* The center clearance shall include crossing altitudes at adjacent reporting points, cruising altitudes, and any other requirements pertinent to the flight. Time of take-off shall be specified by the center only if necessary to coordinate the departure with traffic not released to tower control. If time of take-off is not specified the tower shall determine the take-off time when necessary to coordinate the departure with traffic released to tower control. A clearance void time shall be specified by the center if a delayed departure would result in conflict with traffic not released to tower control. A clearance void time determined by the tower shall not be later than that issued by the center.

(2) *Clearing arrivals.* The center will clear aircraft to the holding point, including holding information and expected approach time in such clearance. If the approach sequence is such that succeeding arrivals would be required to hold at high altitudes, such arrivals should be cleared to other points until lower altitude levels are vacated in the approach sequence.

(i) After coordination with the tower, a center may clear the first arrival to the tower rather than to a holding point.

(ii) After coordination with the tower, a center may clear arrivals to the tower to hold at visual holding points until further advised by the tower.

(3) *Aircraft movement data; approach control towers.* Approach control shall keep centers promptly advised of pertinent data on IFR traffic such as—

(i) Highest altitude in use by approach control at the holding point.

(ii) Average time interval between successive approaches as determined by the tower.

(iii) Revision of the expected approach time issued by the center when the tower calculation indicates a variation of 10 minutes or more.

(iv) Arrival times over holding point (when required).

(v) Departure times of departing aircraft.

(vi) Available information relating to overdue or unreported aircraft.

(4) *Aircraft movement data; centers.* Centers shall keep approach control promptly advised of pertinent data on IFR traffic such as—

(i) Identification, type, and point of departure of arriving aircraft.

(ii) Estimated time and proposed altitude of arriving aircraft over holding point or actual time if aircraft is released to approach control after arrival over the holding point.

(iii) Expected approach time issued.

(iv) Statement that aircraft has been cleared to the tower, or that approach control shall assume control.

The information in (i), (ii), and (iii) of this subparagraph shall be transmitted as follows:

"(Identification), (type) from (point of departure) cleared to the tower" (see subparagraph (2), (i) and (ii) of this paragraph), or

"(Identification), (type) from (point of departure) estimated (holding point), (time), (altitude), expected approach clearance (time). Tower control."

(v) Anticipated delay to departing IFR traffic due to airway congestion.

(vi) Identification and destination of proposed IFR departures.

(5) A tower may authorize flight in a control zone in weather conditions lower than the VFR minimums after coordination with the center.

(6) *Traffic information.* When necessary to issue detailed traffic information to departures, a center may request a tower to forward such information, in standard phraseologies, by reference to flight data possessed by the tower.

(7) Any additional procedures necessary for proper coordination of approach control at individual airports shall be contained in operations letters approved by competent authority.

(d) *Towers not providing approach control service.* The tower may authorize VFR flight in a control zone in weather conditions lower than the VFR minimums after coordination with the center.

(1) *Division of control.* The center shall retain control of arriving aircraft until such aircraft have been cleared to the tower and are in communication with the tower. Not more than one arrival shall be cleared to the tower during IFR conditions.

(2) After coordination with the tower, a center may clear arrivals to visual holding points to hold until further advised by the tower.

(3) *Aircraft movement data; Towers.* Towers shall keep centers promptly advised of pertinent data on IFR traffic such as—

(i) Arrival and departure times.

(ii) Available information relating to overdue or unreported aircraft.

(4) *Aircraft movement data; Centers.* Centers shall keep towers promptly advised of pertinent data on IFR traffic such as—

(i) Identification, estimated time of arrival and proposed altitude of arrivals over holding point or airport at least 15 minutes prior to estimated arrival.

(ii) Clearance of arrivals to the tower.

(iii) Anticipated delay to departing IFR traffic due to airway congestion.

(iv) Identification and destination of proposed IFR departures.

[Supp. 1, 14 F. R. 3332]

§ 26.26-34 *Clearances (CAA rules which apply to § 26.26)*—(a) *General.* Clearances are based solely on expediting and separating air traffic and do not constitute authority to violate the regulations in this chapter. Clearances authorize flight within control zones and control areas only; no responsibility for separation of aircraft outside of these areas is accepted.

(b) *Application.* Clearances shall be issued prior to IFR flight within a control area.

(c) *Broadcast.* A clearance shall not be "broadcast" unless a center or tower so directs. A relay of a clearance over any communications channel which could be intercepted by the pilot is considered a "blind broadcast."

(d) *Clearance limits.* The center shall normally clear an aircraft from the point of departure to the airport of first intended landing.

(e) *Assignment of altitudes.* (1) A center shall normally authorize only one altitude beyond its control area, i. e., that altitude at which the aircraft will enter the adjacent area. Phraseology shall normally be in accordance with § 26.26-35 (e) (1). For example, a flight from Chicago to LaGuardia would be cleared by the Chicago center to the LaGuardia Airport to maintain the altitude at which the aircraft will enter the Cleveland area. Any additional altitudes desired by the pilot will be requested by him en route. In this connection, pilots will be advised "Request further altitude change en route."

(2) The phraseology contained in § 26.26-35 (e) (7) shall be used in clearances to aircraft operating on direct routes which cross civil airways. If more than one altitude is specified, the phraseology in § 26.26-35 (c) (4) shall be used with the phrase "At (altitude)".

(3) When a flight has been cleared into a center's control area at an altitude which is below the established minimums for a subsequent portion of the route, action should be initiated by that center to issue a revised clearance to the aircraft even though the pilot has not requested the necessary altitude change.

(4) The center responsible for control at the point of first intended landing shall clear the aircraft to the tower or issue other appropriate clearance as required. If a control tower is not in operation, the center shall clear the aircraft to the airport, even though it is a repetition of the initial clearance limit.

(5) The airport of intended landing shall still be the clearance limit even though such airport is outside of a control area. If it is necessary for the center controlling the last control area through which the aircraft passes to issue a clearance, such clearance shall include clearance out of the control area. If an amending clearance is not required, it will not be necessary to clear the aircraft out of the control area.

(f) *Clearance procedures.* (1) Pilots filing flight plans specifying VFR within the control area of origin and IFR for a later portion shall not be cleared by the center of origin but shall be advised to contact the appropriate communication facility for clearance. Pilots specifying an instrument altitude for the first portion of a flight and VFR for a later portion shall normally be cleared to the fix at which the instrument portion of the flight terminates, to maintain cruising altitude. Phraseology shall be in accordance with § 26.26-35 (e) (1).

(2) Whenever possible, a combined clearance should be issued by the center adjacent to the area within which landing will be made. If weather and/or traffic conditions require, the center controlling the point of intended landing may request an adjacent center to clear aircraft to a specific point during a specified period. Such clearances shall normally be issued to an aircraft only when within the control area adjacent to the area within which landing is to be made.

(3) Aircraft operating on an established schedule may be cleared through intermediate stops within a control area; however, if the proposed route of flight is through more than one control area, scheduled aircraft may be cleared through intermediate stops within other control areas only after coordination between the centers concerned.

(4) If aircraft are cleared to a point in another control area which is other than the airport of first intended landing, the center responsible for control at such clearance limit will authorize flight to the airport of first intended landing, if practicable.

(5) After the initial clearance has been issued to an aircraft at departure point, it will be the responsibility of the appropriate center to issue an amended clearance to eliminate traffic confliction, and issue traffic information if required.

(6) If the point of departure is not at a sufficient distance from the boundary of an adjacent control area to permit transmission of the necessary flight plan data to the adjacent center and allow adequate time for posting and analysis, coordination between centers shall be effected prior to departure of the aircraft.

(g) *Composition.* Clearances shall be composed as follows:

(1) Flight or aircraft identification.

(2) Clearance limit and route.

(3) Altitude, approach, or departure procedure.

(4) Any special information.

(5) Message delivery information and/or cancellation time if necessary.

(h) *Description.* Clearance items shall be described as follows:

(1) A clearance limit shall be described by specifying the name of the appropriate reporting point, tower, or airport.

(2) The route of flight shall be included in each original clearance when deemed necessary.

(3) Altitude information shall consist of:

(i) The cruising altitude or altitudes.

(ii) Altitudes over those reporting points which are to be crossed at other than the cruising altitude.

(iii) The place or time for starting climb or descent, when necessary.

(iv) Detailed procedures concerning departure or approach altitudes, when necessary.

(i) *Issuance and delivery of clearances.* Clearances shall be issued as follows:

(1) *Departures.* The center shall forward a clearance to the tower with the least possible delay after receipt of request made by the tower, or prior to such request if practicable.

(2) *En route.* When an aircraft is cleared to a clearance limit and requires further clearance beyond that point, the clearance shall be issued at least 5 minutes before the aircraft is estimated over the reporting point where delivery is to be made.

(3) *Responsibility for clearance delivery.* It is the responsibility of the communications agency or aircraft operator to whom the clearance is issued to trans-

mit it to the aircraft immediately when received unless an attempt delivery time is included in the clearance. The center or tower shall be notified if the clearance is not delivered within 5 minutes after receiving the clearance or the attempt delivery time when one is specified. When notification of nondelivery is received, the center shall advise the communication agency of further action to be taken.

[Supp. 1, 14 F. R. 3333]

§ 26.26-35 *Standard phraseologies (CAA rules which apply to § 26.26)*—(a) *General.* Clearances shall be issued in accordance with the phraseologies herein. It is expected that personnel receiving a clearance for transmission to an aircraft will transmit such clearance in the exact phraseology in which it is received. It is essential that each clearance contain positive and concise data, phrased in a standard manner. Each traffic clearance shall be prefixed with the phrase "ATC clears (identification)" whenever a clearance limit is contained in the clearance.

Example: "ATC clears Eastern four to the Richmond airport. Cruise six thousand___"

The phrase "ATC advises (identification)" shall be used whenever information such as expected approach time, undetermined delay, and essential traffic is issued.

Example: "ATC advises Eastern four to expect approach clearance at ________"

The phrase "ATC clears (identification)" shall be used for all other transmissions.

Example: "ATC clears Eastern four to descend to five thousand immediately ________"

These phrases are to be used only when the clearance will be relayed from a center or tower to a pilot through any communications agency such as an air-carrier radio operator, military communications station, or CAA communications station. Towers shall use the phrases whenever a clearance is received from a center for transmission to a pilot. Clearances initiated by tower personnel and issued directly to pilots shall conform to standard tower phraseologies.

(b) *Clearance limit.* The initial clearance shall specify a clearance limit phrased as follows:

"ATC clears (identification)—
1. "From ________ to ________" ("from ________" may be eliminated if clearance is understandable without it); or
2. "Through ________ to ________" (if aircraft is cleared through an intermediate stop to a point beyond the intermediate stop); or
3. "Out of control area zone (number of) miles (direction) of (reporting point). Phraseology (3) will normally be used as a clearance limit only when the flight will not again enter a control area.

(c) *Route of flight.* The route of flight, when included in a clearance, shall be specified immediately after the clearance limit. The following phraseologies, or combinations thereof, shall be used:

1. "Direct";
2. "Via (reporting point) and (reporting point)";
3. "Via (color) airway (number)"; [3]
4. "Cross/join (color) airway (number) (number of) miles (direction) of (reporting point)."

(d) *Local flight.* A clearance for local flight on specified courses of a specified radio facility:

"ATC clears (identification) to fly (location(s)) courses and/or quadrants (name of facility) within radius (number of) miles from station."

(e) *Maintaining altitude.* Clearances requiring that an aircraft maintain a specified altitude, a specified altitude in relation to an overcast or other well-defined formation, or altitude separation from another aircraft.

"Maintain—
1. "(Altitude)"; or
2. "(Altitude) to (reporting point)"; or
3. "(Altitude) until past (reporting point)"; or
4. "(Altitude) until (time)"; or
5. "(Altitude) until advised by (name of) tower"; or
6. "(Altitude) until further advised"; or
7. "(Altitude) while in control area"; or
8. "At least 500 feet above all clouds, haze, smoke, or fog level"; or
9. "(Number of feet) above/below (aircraft identification)."

(f) *Climb or descent.* Clearances requiring that an aircraft climb or descend to a specified altitude:

"Climb to (altitude)—"; or
"Descend to (altitude)—"
1. "Immediately"; or
2. "Immediately after passing (reporting point)"; or
3. "At (time)."
"Climb" or "descend—"
"So as to reach (altitude) at (time)"; or
"At (reporting point)."

(g) Clearance authorizing an aircraft to descend or climb between specified altitude levels in accordance with VFR.

"Climb VFR from (altitude) to (altitude)"; or
"Descend VFR from (altitude) to (altitude)"; or
"Climb VFR above (altitude)"; or
"Descend VFR below (altitude)."
"If not possible (alternate procedures) and advise."

(h) *Change of altitude.* Requiring that an aircraft remain well to the right of a course during altitude change:

"Climb/descend well to right of course."

(i) *Cruising and crossing altitudes.* Clearances requiring that an aircraft cruise at or cross a reporting point at a specified altitude with no specific time for altitude change:

"Cross (reporting point) at (altitude)."
"Cross (reporting point) at or above (altitude)."
"Cruise (altitude)."

(j) *Reporting levels.* Clearances requiring an aircraft to report on leaving or reaching specified altitude levels:

"Report leaving (altitude level or levels)." [4]
"Report reaching (altitude level or levels)." [4]

(k) *Specific instrument approach.* Clearances specifying instrument approach utilizing a radio range:

"Initial approach at (altitude), procedure turn at (altitude) (number of) minutes or miles (direction), and/or final approach on (location) course of (name of) range"; or
"Standard range approach"; or
"Straight in approach to airport."

(l) *Contact approach.* Authorization at a pilot's request for a ground contact approach:

"Contact approach approved; if not possible, (alternate procedures) and advise."

(m) *Any approach.* The omission of specific approach procedures will indicate any type of approach may be used at the discretion of the pilot.

(n) *Departure procedures.* Clearances specifying direction of take-off and/or direction of turn after take-off:

"Take-off (direction) and/or turn (right or left) after take-off."

(o) *Release.* Instructions authorizing a tower to release an aircraft for take-off subject to the discretion of the tower with respect to arriving aircraft:

"Release subject your discretion with respect to (identification(s))."

(p) *Special procedures.*[5] Clearances requiring that an aircraft follow a specific course:

"Make good a track of (number of) degrees magnetic until (time, location, or altitude)"; or
"Make good a tract bisecting (location) quadrant of (name of facility) until (time, altitude, or location)."

(q) *Holding.* Procedures requiring that aircraft be held in a specified direction from a specific holding point:

(1) *Standard pattern.*

"Hold (direction) of (holding point)—
"Until (time)"; or
"Until advised by (name of) approach control on (blank) kilocycles/megacycles." [6]

(2) *Published nonstandard pattern.*

"Hold (direction) of (holding point) nonstandard pattern—
"Until (time)"; or
"Until advised by (name of) approach control on (blank) kilocycles/megacycles." [6]

(3) *Detailed holding instructions:*

1. "Hold on (specified) course of (name of facility) between (location) and point (number of minutes and direction)—
"Until (time)"; or
"Until advised by (name of) approach control on (blank) kilocycles/megacycles." [6]

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[3] Color and number of airway may be omitted if only one possible airway route exists.

[4] "Altitude level or levels" shall include either the desired numerical values or "even" or "odd" thousand-foot levels.

[5] In utilizing these procedures, caution should be exercised to insure aircraft will clear all obstructions and terrain in accordance with specified minimums, and to insure that the desired track can be accomplished effectively, considering wind direction and velocity.

[6] The phrase "on (blank) kilocycles/megacycles" need not be used when issuing holding instructions to scheduled air-carrier aircraft.

2. "Make all turns (direction) of course;"
3. "Make all turns in (direction and quadrant identification) quadrant."

(4) Detailed holding instructions shall normally be issued:

(i) When assigning nonstandard patterns which are not depicted on United States Coast and Geodetic Survey radio facility charts; or

(ii) On pilot's request; or

(iii) When deemed necessary by the controller.

(r) *Visual holding.* Instructions requiring that an aircraft be held at a specific location by visual reference to the ground or water:

"Hold at (location)
"Until (time); or
"Until advised by (name of) tower."

(s) *Expected approach time.* Clearances relative to expected approach time:

"Expect approach clearance at (time)"; or
"No delay expected."

(t) *Indefinite delay.* Delay not determined. (Revised expected approach time shall be forwarded as soon as determination can be made.)

"Delay indefinite expect approach clearance not later than (time)."

(u) *Longitudinal separation clearances.* Clearances requiring that an aircraft lose time to establish longitudinal separation from another aircraft, or to maintain longitudinal separation from another aircraft:

"Lose time so as to arrive over (reporting point) at (time)."
"Maintain (number of minutes) separation from (aircraft identification)."

(v) *Essential traffic information.* Phraseologies to be used in connection with the issuance of essential traffic information:

"Traffic is (essential traffic information); or
"Additional traffic is (essential traffic information)"; or
"No essential traffic reported."

(w) *Approach control.* The following shall constitute the last item of the center clearance when an aircraft, previously issued a holding clearance, is to contact a tower for further clearance. For example, this phraseology will apply when an aircraft holding at a higher altitude than "over traffic" is subsequently cleared to a lower level and released to Approach Control:

"Contact (name of) Approach Control on (blank) kilocycles megacycles for further clearance." [7]

[Supp. 1, 14 F. R. 3333]

§ 26.26–36 *Traffic information (CAA rules which apply to § 26.26)*—(a) *Essential traffic.* Essential traffic for a particular aircraft is same-direction IFR traffic on the same or converging courses which is, or will be, 1,000 feet or less vertically and within less than minimum longitudinal separation from such aircraft; and opposite-direction IFR traffic on the same or converging courses which is, or will be, within less than the minimum time separation for altitude change (§ 26.26–22 (d)) and occupies, or will pass through, the altitude of such aircraft.

(b) *Detailed traffic information.* Direction of flight and estimated time and altitude over the reporting point nearest the point at which the aircraft which are essential traffic should pass, overtake, or approach; this information and any alternate procedures issued shall be given when an aircraft will pass through the altitude level of other aircraft concerned.

(c) *General traffic information.* Direction of flight and cruising altitude shall be given when the aircraft which are essential traffic are at different constant altitudes.

(d) *Issuance.* Traffic information should be issued to aircraft:

(1) When deemed necessary by the controller;

(2) When right-side separation is effected;

(3) At any time if requested by the pilot; or

(4) At any time if requested by the aircraft operator for a specific flight or for more than one flight.

(e) Traffic information issued to aircraft separated by 5 minutes in accordance with § 26.26–22 (b) (1) (ii) shall include the filed air speed of the aircraft concerned.

[Supp. 1, 14 F. R. 3335]

§ 26.26–37 *Emergency procedures (CAA rules which apply to § 26.26)*—(a) *General.* The various circumstances surrounding each emergency situation preclude the establishment of exact detailed procedures to be followed. The procedures outlined herein are intended as a general guide to air traffic control personnel. Centers and towers shall maintain full and complete coordination, and personnel shall use their best judgment in handling emergency situations.

(b) *Emergency descent.* Upon receipt of advice that an aircraft is making an emergency descent through other traffic, immediate steps shall be taken to minimize confliction with other aircraft. ATC personnel shall immediately broadcast by means of the appropriate radio facility or, if not possible, request the appropriate communications station to immediately broadcast the following:

"Emergency to all concerned: Emergency landing at (name of) airport. All aircraft below (number of) feet within (number of) miles of (name of radio facility) leave (location) course(s) immediately."

(1) *Action by pilot.* It is expected that pilots receiving such broadcast will clear the specified areas, maintaining the last assigned altitude and stand by on the appropriate radio frequency for further instructions from the center or tower.

(2) *Subsequent action by Air traffic control.* Immediately after such emergency broadcast has been made the center or tower concerned shall forward further instructions to all aircraft involved as to additional procedures to be followed during and subsequent to the emergency descent.

(c) *Two-way radio failure.* If two-way radio communication between an aircraft and the ground fails prior to the aircraft establishing communication with the tower, the center may issue an appropriate clearance to be broadcast over suitable radio facilities. If failure occurs after the aircraft and tower are in communication, the tower may broadcast any necessary clearance to the aircraft.

(1) *Pilot actions.* (i) The pilot will observe one of the following procedures:

(*a*) If operating under VFR conditions, proceed under VFR and land as soon as practicable, or

(*b*) Proceed according to the latest air traffic clearance.

(ii) If the pilot proceeds according to the latest traffic clearance but has not received and acknowledged a clearance to the tower and if other instructions to the contrary are not received, he shall be expected to observe the following and control will be effected accordingly:

(*a*) If the pilot has received and acknowledged a clearance to the destination airport or the radio facility serving that point, he shall continue flight at the altitude(s) last assigned by air traffic control, or the minimum instrument altitude,[8] whichever is the higher, to the radio facility serving the destination airport.

(*b*) If the pilot has received and acknowledged a clearance to a point other than the destination airport or the radio facility serving the destination airport, he shall continue flight at the altitude(s) last assigned by air traffic control or the minimum instrument altitude,[8] whichever is the higher, to the radio facility serving the destination airport.

(*c*) If holding clearance has been received, the pilot shall comply with the clearance until such time as it will be necessary to continue flight so as to arrive at the radio facility serving the destination airport at the expected approach time last received and acknowledged, maintaining the last assigned altitude or the minimum instrument altitude,[8] whichever is the higher.

(*d*) If holding clearance has been received, but no expected approach time has been received, the pilot shall comply with the clearance until the time air traffic control has specified that further clearance may be expected. He shall then continue, maintaining the last assigned altitude or the minimum instrument altitude,[8] whichever is the higher.

(iii) *Approach.* Descent from the altitude maintained to the radio facility serving the destination airport shall be made on the final approach course and shall start at the expected approach time last received. If no expected approach time was received, descent shall be started at the last estimated arrival time specified by the pilot, or as soon as possible thereafter. A full standard instrument approach should be executed unless a VFR approach can be made.

(iv) *Alternate airport.* If approval of the aircraft operator is obtained, a center

[7] The phrase "on (blank) kilocycles megacycles" need not be used in clearances issued to scheduled air carrier aircraft.

[8] The minimum instrument altitude referred to is the minimum established for that portion of the route over which the operation is conducted, regardless of the direction of flight.

may request a clearance to be broadcast to the pilot to proceed, at the minimum instrument altitude, to the alternate airport specified in the flight plan.

[Supp. 1, 14 F. R. 3335]

§ 26.26-38 *Unreported aircraft (CAA rules which apply to § 26.26)*—(a) *Unreported aircraft.* To minimize any possibility of collision with unreported aircraft, the center or tower shall restrict other traffic which may conflict until 30 minutes after whichever of the following is applicable: The time at which approach clearance was delivered to the pilot; the expected approach time last delivered to the pilot; the arrival time over the radio facility serving the destination airport; or the current ATC or pilot estimate (whichever is the later) of initial arrival over such radio facility.

(b) *Resumption of normal traffic.* If the aircraft is still unreported after the above period, pertinent information concerning the aircraft shall be forwarded to operators and pilots of the aircraft concerned and normal control resumed if they so desire. It is the responsibility of such operators and pilots to determine whether they will resume normal operations or take other action.

[Supp. 1, 14 F. R. 3335]

Airport traffic control procedures.

§ 26.26-61 *General (CAA rules which apply to § 26.26).* (a) Responsibility of airport traffic control towers:

(1) An airport traffic control tower is responsible for the issuance of clearances and information to pilots of aircraft for the purpose of preventing collision between:

(i) Aircraft operating on the ground at the landing area.

(ii) Aircraft and vehicles operating on the landing area.

(iii) Aircraft in the traffic pattern, and landing and taking off at the landing area.

(iv) Aircraft operating under instrument flight rules after control of such aircraft has been delegated to the tower by the appropriate air route traffic control center.

(2) An airport traffic control tower is also responsible for the issuance and relay of information and clearances which will prevent unnecessary delays to aircraft using a landing area, and which will permit the proper use of the landing area by aircraft.

(b) *Responsibility of pilots.* (1) When flying in VFR weather conditions it is considered the direct responsibility of the pilot to avoid collision with other aircraft. Under such conditions, the information and clearances issued by the control tower are intended to aid pilots to the fullest extent in avoiding collisions.

(2) When flying in IFR weather conditions it is obviously impossible for the pilot to assume the responsibility of avoiding collision with other aircraft except as directed by the ground control agency. Therefore, it is of the utmost importance that all clearances issued by a control tower to pilots of aircraft under its jurisdiction be adequate, concise, and definite, inasmuch as the pilot has no other means of ascertaining the proximity of other aircraft.

[Supp. 1, 14 F. R. 3335]

§ 26.26-62 *Control of traffic on and in vicinity of landing area (CAA rules which apply to § 26.26)*—(a) *General.* Airport traffic controllers shall maintain a continuous watch on all visible flight operations in the control zone, including aircraft, vehicles, and personnel on the landing area, and shall control such traffic in accordance with the procedures set forth herein and all applicable air traffic rules. If there are other landing areas within the zone, traffic at all landing areas within the zone shall be coordinated so as to eliminate any hazardous conflictions of traffic patterns.

(b) *Critical positions of aircraft in the traffic and taxi patterns.* The following positions of aircraft in the traffic and taxi patterns (illustrated in fig. 1) are the positions where the aircraft normally receives airport traffic control clearances. The aircraft should be watched closely as they approach these positions so that proper clearances may be issued without delay. Where practicable all such clearances should be issued without waiting for the pilot to initiate the call.

(1) Pilot initiates call to taxi for departing flight. Runway-in-use information and taxi information given.

(2) If there is conflicting traffic the departing aircraft will be held at this point. The pilot will normally run up motors here.

(3) Take-off clearance is issued here, if not practicable at position 2.

(4) Clearance to land or landing sequence number is issued here.

(5) Clearance to taxi to hangar line or parking area is issued here.

(6) Parking directions issued here if necessary.

(c) *Determining proper runways to use for landings and take-offs.* (1) When surface wind velocity is 6 miles per hour or more, aircraft shall ordinarily be authorized to use the runway most nearly alined into the wind and the tetrahedron shall, if controllable, be set so as to indicate such runway. (See fig. 2 (b).)

(2) The tetrahedron, if controllable, will release automatically and swing into the wind when the velocity reaches a predetermined value. Ordinarily this will be between 10 and 15 miles per hour.

(3) When the surface wind velocity is less than 6 miles per hour, aircraft shall be authorized to use the runway which has been designated as the "calm wind" runway. This shall normally be the runway having the most advantages such as greater length, shorter taxying distance, better approach, etc. The tetrahedron shall, if controllable, be set so as to indicate such runway under these conditions. (See fig. 2 (a).)

(4) If the runway in use is not considered suitable for the operation involved, the controller may offer a choice of runway or the pilot may request clearance to use another runway.

(d) *Control of taxying aircraft.* (1) The importance of issuing definite, concise directions to pilots of taxying aircraft cannot be overemphasized. The visibility problem in an airplane is most acute when taxying. Very few aircraft afford any forward vision for several yards directly in front of the airplane, and the pilot must depend to a large degree upon the control tower to issue necessary information which will assist him in determining the proper taxi route and preventing collision with other aircraft or objects.

(2) It is particularly hard for the pilot to determine the best taxi route on a strange airport. Clearances and information to pilots concerning taxi routes should be simple and direct such as "Turn left at first intersection, taxi straight ahead to the end of the runway, then turn right," etc. The pilot should also be warned of parked aircraft or other objects along or near his taxying route.

(3) Aircraft should not be permitted to taxi on the runway if at all possible to provide other taxying routes. The guiding principle in handling taxying traffic is "keep the runway-in-use ready for use as much as possible."

(i) Aircraft shall not be permitted to hold on the end of the runway-in-use whenever another aircraft is effecting a landing except at those airports where there are no intersecting taxiways. At such airports the aircraft shall be held clear of the edge of the runway and at

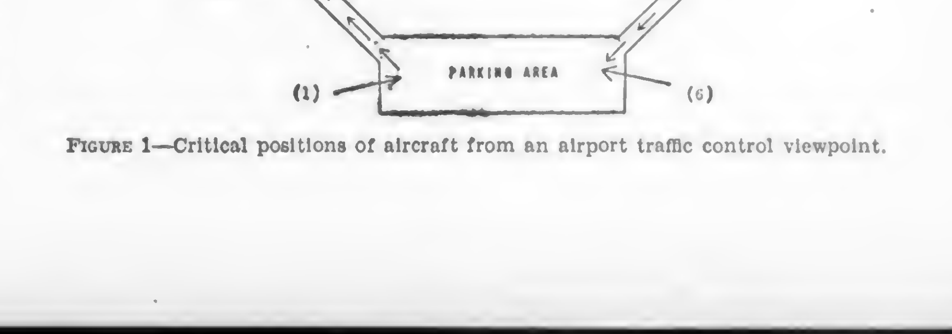


FIGURE 1—Critical positions of aircraft from an airport traffic control viewpoint.

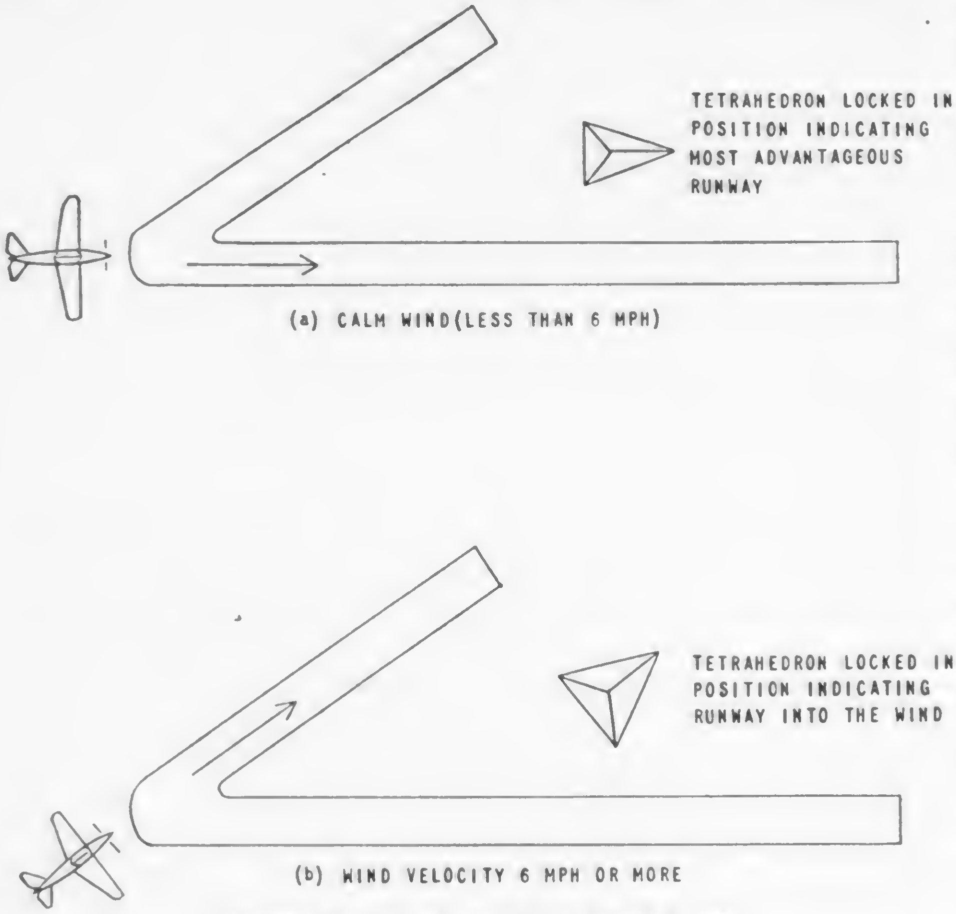


FIGURE 2—Method of determining runway to use.

an angle of 90 degrees from the landing direction until cleared to take-off position. (See fig. 3.)

(4) The direction of taxying aircraft and avoidance of collision within loading and parking areas is considered the primary responsibility of the aircraft operator and/or airport management, as well as the pilot.

(e) *Control of traffic in the traffic pattern.* (1) Aircraft in the traffic pattern shall be controlled to provide the separation minimums outlined below except that:

(i) Formation flights of aircraft are exempted from the separation minimums with respect to separation from other aircraft of the same flight.

(ii) Aircraft operating in different areas or lanes on airports equipped with runway or mat facilities suitable for simultaneous landings or take-offs are exempted from the separation minimums.

(iii) Separation minimums shall not apply to aircraft operating under military necessity as determined by competent authority.

(2) Sufficient separation shall be effected between arriving aircraft to insure that the succeeding landing aircraft on the same runway will not cross the airport boundary in its final glide until the preceding aircraft has cleared the runway-in-use. (See fig. **4**.)

(3) Sufficient separation shall be effected between the departing aircraft to insure that an aircraft will not commence take-off until the preceding departing aircraft has crossed the end of the runway-in-use.

(4) Sufficient separation shall be effected between arriving and departing aircraft to insure:

(i) That a landing aircraft will not cross the airport boundary in its final glide until the preceding departing aircraft has crossed the far end of the runway-in-use.

(ii) That an aircraft taking off will not commence take-off until the preceding landing aircraft has cleared the runway-in-use.

(5) Sufficient separation should be effected between aircraft in flight in the traffic pattern to allow the spacing of arriving and departing aircraft as outlined in the foregoing. In no event shall separation between aircraft in flight be less than the minimums specified by Air Force, Navy, or Civil Air Regulations.

(i) At many airports the location of the control tower will not permit accurate determination of separation between the paths of successive aircraft in the pattern, landing, or taxying on the same runway or taxiway, particularly when the movement of these aircraft is at an angle to the controller's line of vision. Extreme caution, therefore, should be exercised in the issuance of specific control instructions which are used to prevent collision. For example, when a succeeding aircraft is overtaking the aircraft ahead a specific control instruction might turn the preceding aircraft into the path of the other.

(f) *Control of other than aircraft traffic on the landing area.* (1) The movement of personnel or vehicles on the landing area proper shall not be permitted unless permission has been granted for such movement by the airport traffic controller on duty in the control tower. Personnel, including drivers of all vehicles, shall be required to stop and wait for radio clearance or light signal from the control tower before crossing any runway or taxi strip unless on a portion of the landing area marked off by lights, flags, or other conventional warning signals. In radio conversations to pilots, the airport traffic controller shall identify personnel or vehicles on the landing area as distinctly as possible.

(2) The maintenance of any landing area requires considerable use of vehicular traffic, such as snow plows, tractors, mowers, maintenance trucks, official cars for inspections and miscellaneous other equipment in addition to the working parties and other personnel required for maintenance. Considerable care and judgment must be exercised in the dispatch of personnel or vehicles on any portion of the landing area since a collision with a fast-moving aircraft would be disastrous. At certain points during the take-off and landing of aircraft, a change of direction to avoid an obstacle will almost certainly result in ground-looping or overturning the aircraft with probable serious results. Another difficulty connected with the dispatch of personnel and vehicular traffic on the landing area is that the operators of the equipment and the personnel on foot are not always aware of the difficulties and limitations of handling heavily loaded aircraft and may be inclined to fail to surrender sufficient right-of-way for safe operation.

(3) In a few cases commanding officers or airport managers require all vehicular traffic to be equipped with radio receivers so that they may receive control tower signals, but in the majority of instances all pedestrian and vehicular traffic are controled by light signals.

(4) Where continuous vehicular movement is involved over limited portions of the landing area, such as mowing the grass, the mowing is usually accomplished in a portion of the field not being used for landing operations with the particular wind condition at that time. The mowing equipment is marked with appropriate flags or lights, and the mower may not cross the taxi strips or runways without receiving the proper light signal.

(5) When construction work is in progress, the normal procedure is to close the entire construction area to aircraft operations and permit pedestrian and vehicular traffic to move at will within the marked-off area. Construction areas are usually marked off with appropriate flags in the daytime and appropriate lights at night.

(g) *Authorizing use of landing area by pilots of arriving aircraft.* (1) If a pilot enters a control zone without proper authorization, he shall be permitted to land if his actions indicate he so desires. If circumstances warrant, an airport traffic controller may ask pilots of aircraft with whom he is in contact to give way so as to remove as soon as possible the hazard introduced by such unauthorized operation. In no case shall permission to land be withheld indefinitely.

(i) In cases of emergency, such as loss of radio communication, a pilot may be required, in the interests of safety, to enter a control zone and effect a landing without proper authorization. Airport traffic controllers should recognize the possibilities of emergency action and render all assistance possible. The entire concept of air traffic control is service to the flying public. While it is true that in some isolated instances a pilot might deliberately disregard regulations and enter a control zone in an unauthorized manner while not under stress of an emergency, the airport traffic controller should assist the pilot and take steps toward possible disciplinary action after the pilot has landed. Under no circumstances should discussions which have no relation to traffic control be carried on over the radio.

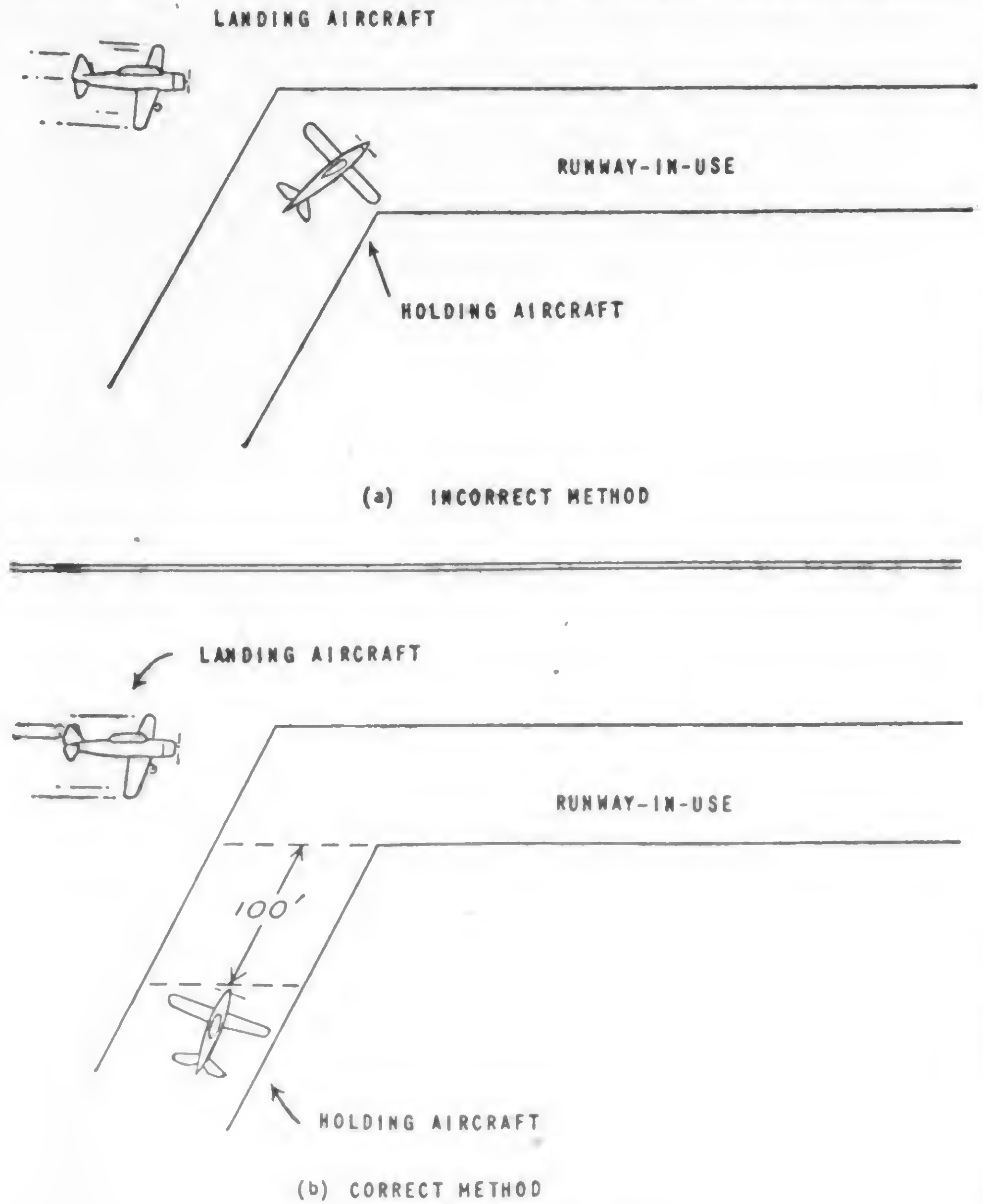


FIGURE 3—Method of holding aircraft.

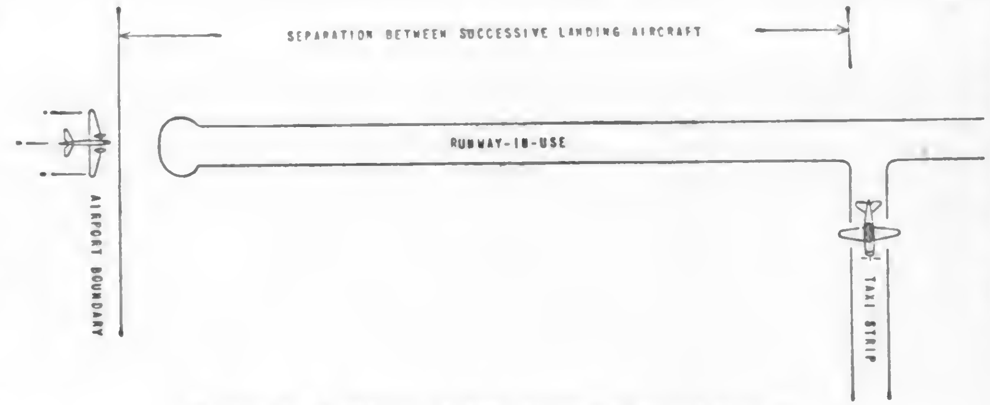


FIGURE 4—Separation between successive landing aircraft.

[Supp. 1, 14 F. R. 3336]

§ 26.26–63 *Visual signal procedures (CAA rules which apply to § 26.26)*—(a) *Portable traffic light.* The portable traffic control light is a directive light which emits an intense, narrow beam of light. The color of the light (white, green, or red) is controlled by the operator through a system of levers and triggers in the two handles. Signals are readily discernible to the pilot of any aircraft visible to the operator.

(b) *Advantages and disadvantages of the portable traffic signal light.* (1) The controller should be thoroughly familiar with the limitations of the traffic control light, and evaluate its capabilities in connection with its use.

(2) The portable traffic light has the following advantages:

(i) No radio equipment is required in the aircraft and therefore all aircraft can be controlled whether or not they possess radio.

(ii) The traffic light provides an emergency method of control in the event of radio failure—either in the tower or the aircraft.

(3) The disadvantages are:

(i) The pilot may not be looking at the control tower at the time a signal is directed toward him.

(ii) The information transmitted by a light signal is limited. One may only transmit an approval or disapproval of the pilot's anticipated actions to him. No explanatory or supplementary information can be transmitted.

(c) *Operation of portable traffic light.* (1) The portable traffic light shall be used to control the movement of personnel and vehicles on the landing area and the landings and take-offs of any aircraft not equipped with radio unless such movements or landings and take-offs have been prearranged with the traffic controller.

(2) Signals from a portable traffic control light shall mean the following:

Color and type of signal	On the ground	In flight
Steady green	Clear for take-off	Cleared to land.
Flashing green	Cleared to taxi	Return for landing (to be followed by steady green at proper time).
Steady red	Stop	Give way to other aircraft and continue circling.
Flashing red	Taxi clear of landing area (runway) in use.	Airport unsafe—do not land.
Flashing white	Return to starting point on airport	
Alternating red and green	General warning signal—Exercise extreme caution	

(See figs. 5 and 6.)

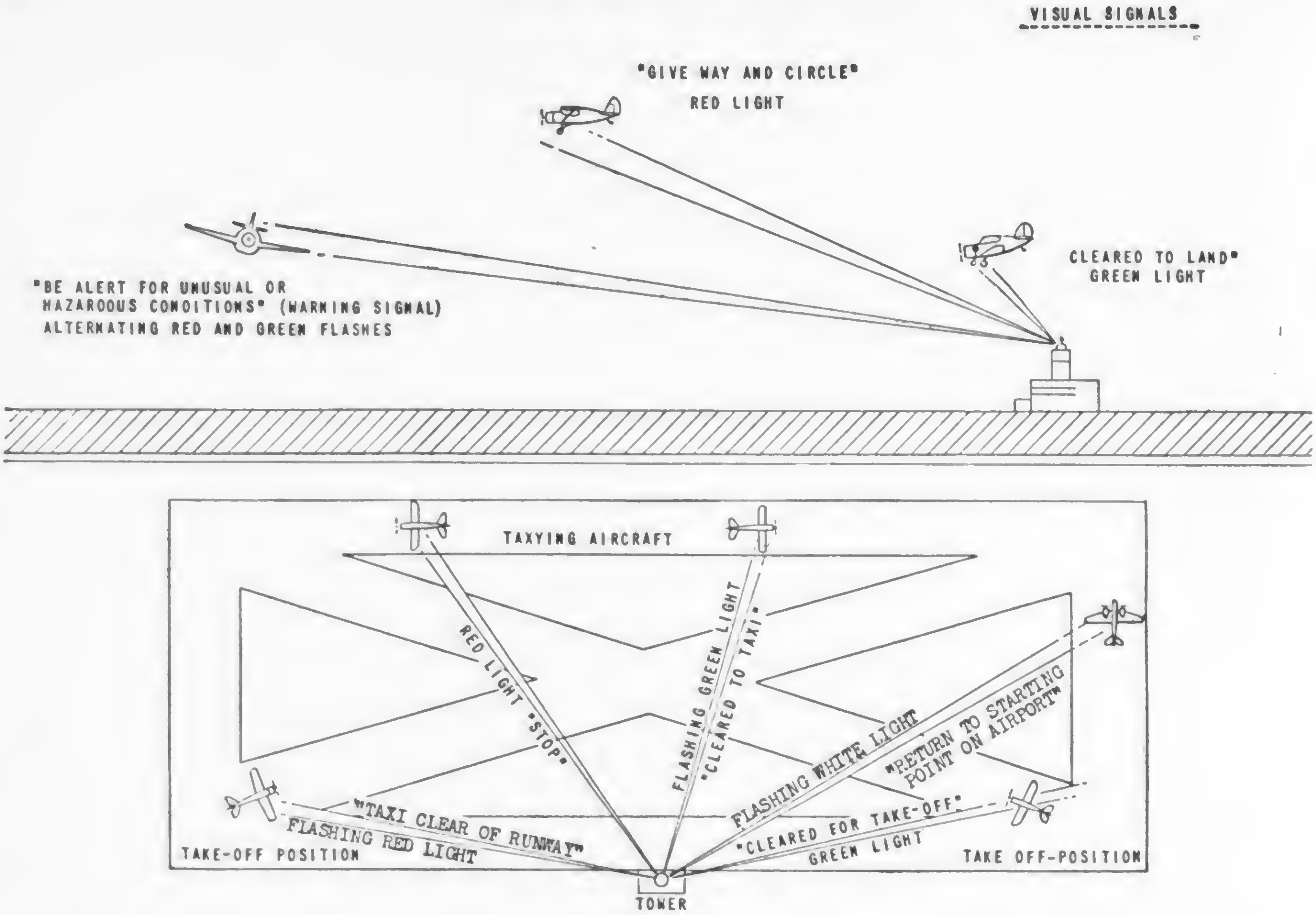


FIGURE 5.

(i) *General warning signal.* A series of alternating red and green flashes from a directed traffic control light shall be used as a general warning signal to advise a pilot or driver of a vehicle on the landing area to be on the alert for hazardous or unusual conditions. As an example, the warning signal may be directed to a pilot in flight to indicate a change of runway since this can prove hazardous if the pilot attempts to land cross-traffic or cross-wind.

(*a*) In controlling airport traffic by means of visual signals, the general warning signal shall be directed to pilots of the aircraft concerned as follows (see fig. 6):

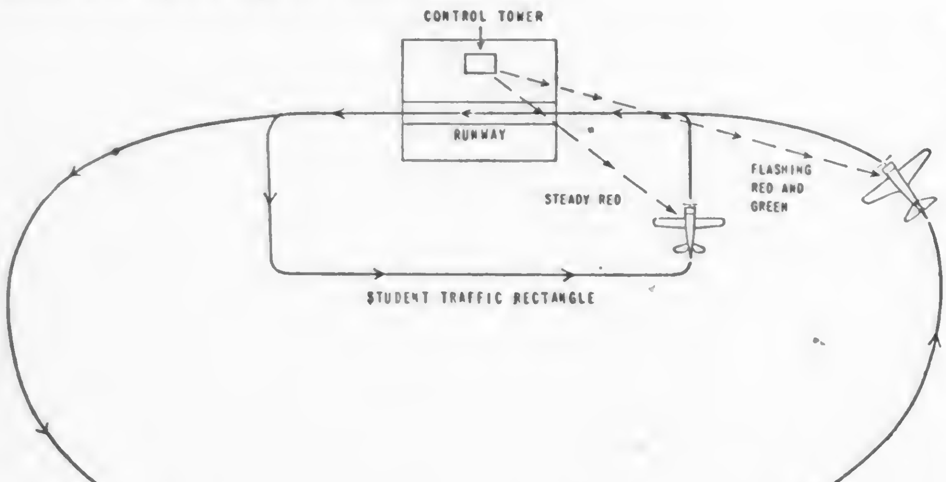


FIGURE 6—Example of the use of general warning light when two airplanes are on converging courses.

(*1*) When aircraft are converging and there is a possibility of collision.

(*2*) When hazardous conditions are present and the pilot must be unusually alert in order to complete the operation safely. Such conditions include obstructions, soft field, ice on runway, and many others.

(*3*) When mechanical trouble is apparent to the controller and he has reason to believe that the pilot may not be aware of it.

(*4*) At any other time when believed necessary in the opinion of the controller.

(*b*) Attention is directed to the fact that the warning signal is not a prohibitive signal and may be followed by either a red or green light as circumstances warrant.

(*c*) A pilot wishing to attract the attention of the airport traffic controller during the hours of darkness may turn on a landing light and taxi the aircraft in a position so that the light is visible to the airport traffic controller. The landing light should remain on until appropriate signals are received from the tower, after which acknowledgment may be expected from the pilot as provided for in non-radio-equipped aircraft. Pilots of aircraft not equipped with landing lights may blink their navigation lights to attract the attention of the tower.

(*d*) *Light signals to indicate restriction of VFR operations in the control zone.* (1) During the hours of daylight, the rotating airport beacon shall be operated to mean that the ground visibility in the control zone is less than 3 miles and/or the ceiling is less than 1,000 feet and that a traffic clearance is required for landings, take-offs, and flight in the traffic pattern. (See fig. 7.)

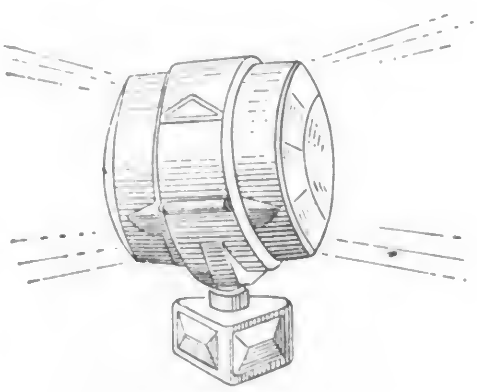
(2) Between sunset and sunrise, flashing lights outlining the traffic direction indicator shall be operated to mean that ground visibility in the control zone is less than 3 miles and/or the ceiling is less than 1,000 feet and that a traffic clearance is required for landings, take-offs, and flight in the traffic pattern.

(e) *Light signals to indicate clockwise (to the right) flow of traffic.* (1) A flashing amber light shall be operated to mean that a clockwise flow of traffic around the airport is required unless otherwise authorized by the control tower. (See fig. 7.)

(f) *Use of flag signals.* (1) Flag signals are used by the military and naval services for special signals which usually apply only to the local activities at a particular landing area. Since these signals are not standard and usually have a special meaning at a particular location, it is not expected that an itinerant pilot will know their meaning or be guided by them. Accordingly, flash signals may be used for special local activities (such as primary or secondary training flights) as directed by the local commanding officer, but should not be used to govern flight of other than local aircraft unless it is known that the itinerant pilot is familiar with the flag signals and their meaning.

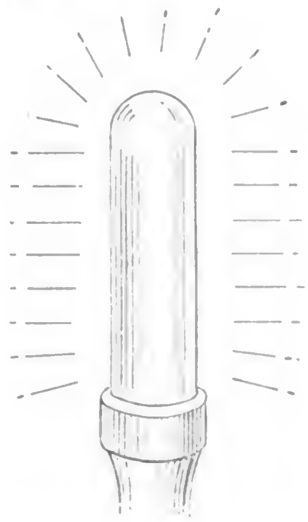
(g) *Special light signals.* (1) Some military and naval establishments have special light signals, such as "course lights," which indicate landing direction, runway-in-use, traffic pattern to use, and other similar information for local activities. These lights are to be used as directed by competent authority, but as in the case of flag signals are to be confined to direction of pilots known to be familiar with the meaning of the special light signals.

[Supp. 1, 14 F. R. 3338]



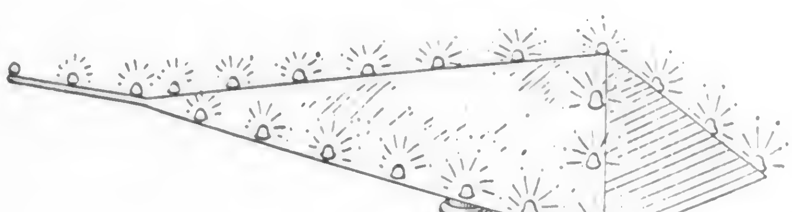
ROTATING BEACON (day only)

Ceiling less than 1000 feet and/or ground visibility less than 3 miles. Traffic clearance required for landings, take-offs, or flight in traffic pattern in a control zone.



FLASHING AMBER LIGHT

CLOCK-WISE FLOW OF TRAFFIC



FLASHING LIGHTS OUTLINING TRAFFIC DIRECTION INDICATOR (night only)

Ceiling less than 1000 feet and/or ground visibility less than 3 miles. Traffic clearance required for landings, take-offs, or flight in traffic pattern in a control zone.

FIGURE 7—Light signals used in airport traffic control.

§ 26.26-64 *Radiotelephone procedure and technique (CAA rules which apply to § 26.26)*—(a) *General.* The operation of the radiotelephone facilities of an airport traffic control tower shall be accomplished in accordance with procedures outlined herein.

(b) *Calls and replies.* (1) Airport traffic control towers shall be identified during radiotelephone communications by the name of the airport followed by the word, "Tower."

Examples: "Washington tower," "Meacham tower," "Bolling tower."

(2) It is expected that aircraft pilots will call, for example, "Washington tower" when they wish to establish communications with the Washington Airport Traffic Control tower and for example, "Washington radio" when they wish to establish communications with the Washington airway communications station.

(3) Aircraft shall be identified during radiotelephone communications in the following manner:

(i) Military aircraft—by the name of the service followed by the last four digits of the service serial number, as

"Air Force seven eight two nine."
"Navy four three six one."
"National Guard two one six one."

(ii) Civilian aircraft—by the aircraft type,[9] if known, followed by the last four digits of the certificate number, as

"Waco A, R, C, D," or where necessary,
"Stinson three seven two Y."

(iii) Aircraft of foreign registry—by the aircraft type,[9] if known, followed by the last four digits or letter of the license or certificate number or registry, as

"Waco two one six eight."
"Waco, able roger charlie dog."

(iv) After radio contact has been established, the last half of the aircraft radio identification may be reduced to not less than two digits or letters, provided there is no possibility of error, as

"Waco six eight."

(v) The abbreviated name of the air-carrier operator and trip number shall be utilized when calling air-carrier aircraft. Air-carrier trip numbers are spoken as a group figure (instead of as a serial figure) in accordance with the following examples:

"United fifteen."
"American six."
"Eastern twenty-two."
"TWA four thirty-six."

(4) The name of the pilot should not ordinarily be utilized in routine two-way radio communication.

(5) The call-up procedure to be utilized in airport traffic control radiotelephone communications shall consist of the following:

Item	*Example*
1. Designation of the station called.	"Waco one eight one four."
2. "This is" ________	"This is."
3. Designation of the calling station.	"Cleveland tower."
4. Invitation to reply_	"Over."

[9] Until the aircraft type is determined the whole certificate number or registry should be used.

(6) The reply to an initial call-up shall consist of:

Item	Example
1. Designation of the station called.	"Cleveland tower."
2. "This is"	"This is."
3. Designation of the answering station.	"Waco one eight one four."
4. Invitation to reply.	"Over."

(7) Communication shall be initiated by call-up and reply when:

(i) Con munication has not been established.

(ii) Previous contact has been terminated.

(c) *Exchange of communications.* (1) After contact has been established in accordance with the above, the airport traffic control tower should make a second call-up followed immediately by the message in accordance with the following:

Item	Example
1. Designation of the station called.	"WACO one four."
2. Body of the communication.	(Message).
3. Invitation to reply	"Over."

When no chance of mistaking identity of the tower is likely, the "This is" and name of the tower shall be omitted after original contact has been made.

(2) If it is reasonably certain that the aircraft will receive the initial call-up the tower may follow the first call-up with the message without waiting for the reply from the aircraft.

(3) After communication has been definitely established, it may be continued without further call-up or identification other than preceding the message with the identification of the aircraft until termination of the contact.

(d) *Termination of communication*—(1) *Acknowledgement of receipt.* A receiving station (either tower or aircraft) shall acknowledge receipt of a radiotelephone message by transmitting the aircraft identification followed by the word "roger," or other applicable procedure word. Example:

"Stinson two three one five, roger."
"Air Force six seven two four, roger."

The examples given above could be transmitted by either the tower or the aircraft since the object is to identify the aircraft concerned and to acknowledge the message received. It is usually unnecessary to identify the tower concerned as no mistake in tower identity is likely, but the aircraft concerned should be identified in every instance to prevent any possible mistake in aircraft identity.

[Supp. 1, 14 F. R. 3339]

§ 26.26-65 *Standard traffic clearances and phraseologies (CAA rules which apply to § 26.26)*—(a) *Traffic clearances*—(1) *General.* An airport traffic controller shall issue such traffic clearances and other information as are necessary for the prevention of collisions between aircraft under his jurisdiction. (See Fig. 8.)

(2) A clearance issued by an airport traffic control tower is similar to a clearance issued by an air route traffic control center in that it is authority for a pilot to proceed only insofar as known air traffic conditions are concerned and does not constitute authority for a pilot to violate any provision of Air Force, Navy, or Civil Air Regulations. The relay of advice to pilots from the airport management is permitted. When such relay of advice is undertaken by controllers, the pilot shall be informed that the information is from the airport management. However, denial of clearance for take-off shall be based only on considerations of safety. No violations of § 60.19 of this chapter shall be reported unless a take-off is made contrary to a controller's clearance based solely on safety.

(i) Clearances issued by airport traffic controllers are permissive in nature and predicated upon known traffic conditions which affect safety in aircraft operation. Such traffic conditions will include not only aircraft in the air within the control zone and on the landing area over which control is being exercised, but also any vehicular traffic or other obstructions not permanently installed on the landing area in use.

(ii) When it is stated that air traffic control clearances are permissive in nature, it is intended to convey the thought that such clearances are authority for a pilot to operate his aircraft in accordance with a predetermined plan. If the plan, as approved by the airport traffic controller, is not suitable to the pilot, he may request, and, if practicable, obtain approval of an alternate plan.

(iii) The clearances issued by airport traffic controllers relate to traffic and field conditions only, with the exception of relaying advice or information from the commanding officer or the airport manager with regard to use of the landing area. For example, a pilot may request and receive a traffic clearance while piloting an aircraft not properly equipped for the type of flight concerned. The mere fact that the pilot received a traffic clearance for the flight involved does not relieve the pilot of any responsibility whatsoever in connection with a possible violation of Air Force, Navy, or Civil Air Regulations.

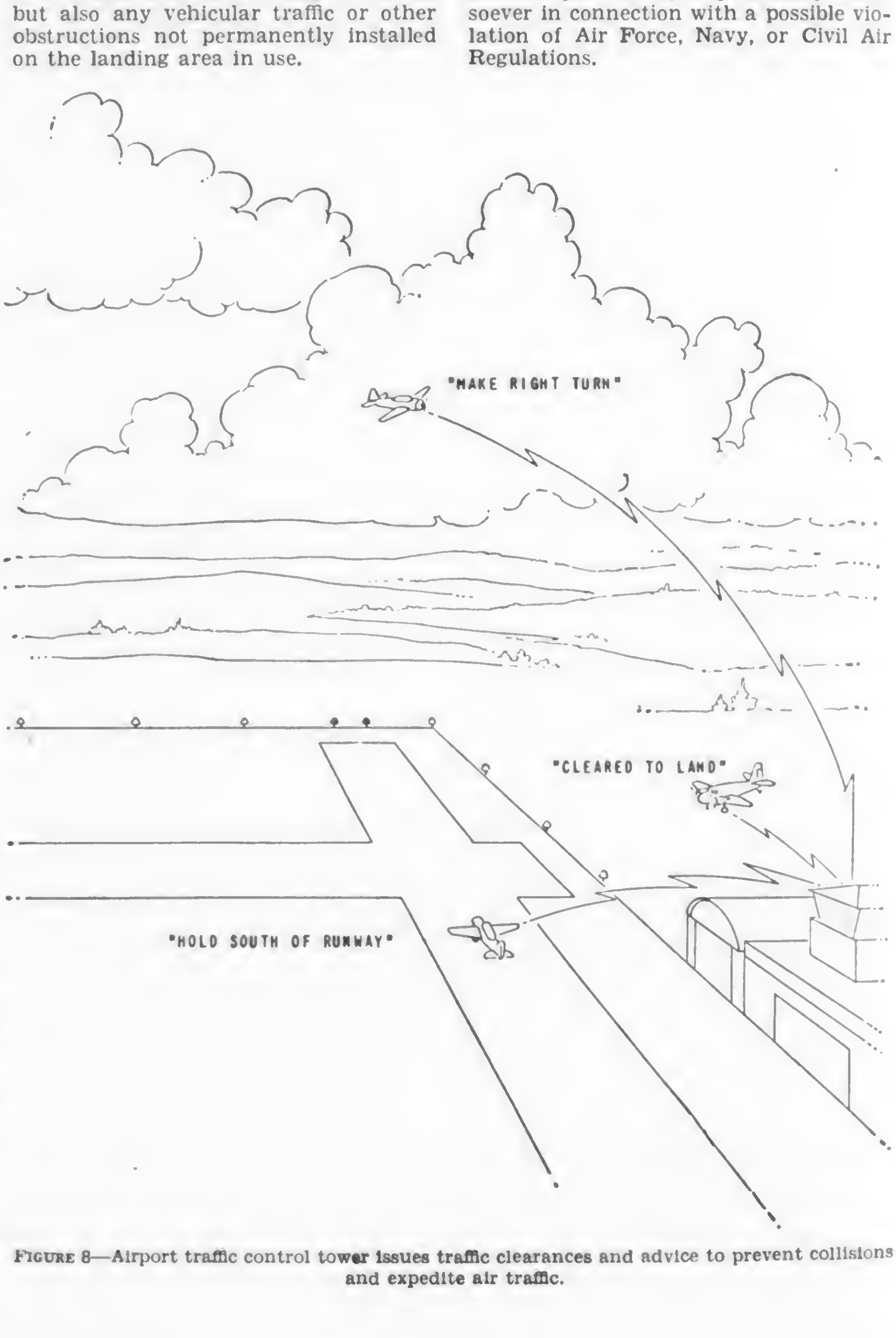


FIGURE 8—Airport traffic control tower issues traffic clearances and advice to prevent collisions and expedite air traffic.

(b) *Standard phraseologies for traffic clearances.* (1) In order to reduce the transmission time for each tower message, and to decrease misunderstandings, phraseologies have been standardized for use in airport traffic control. However, unusual situations will occur and the controller will have to exercise his best judgment in the use of additional phraseologies. In such cases he should use supplementary rather than substitute phrases.

(i) The standard phraseologies and clearances are listed in accordance with the purpose phrased by them, such as "clearance to enter traffic pattern," "clearance to land," "clearance to taxi," and other similar authorizations.[9a]

(2) *Clearance to enter traffic pattern.* (i) Clearance governing flight from a visual reporting point, holding point or fix, or other outlying point to the traffic pattern at the landing area shall be in the following form:

1. "(Flight identification).
2. "This is (name of tower) tower.
3. "(Reporting point).
4. "(Time—minutes only).
5. "At (altitude in thousands and hundreds of feet).
6. "Cleared to enter traffic pattern.
7. "At (specified altitude, if necessary).
8. "Runway (number of runways in use).
9. "Wind (direction and velocity)."
10. (Any special information).

Example: "Air force seven eight three four. This is Nashville tower, Lebanon, four six, at two thousand, cleared to enter traffic pattern, runway two seven, wind west eight."

When parallel runways are available, the runway in use shall be designated in the following manner:

Example: "Runway two three, left"; "Runway one eight, center."

(ii) The clearance to enter traffic pattern is issued to a pilot whenever it is desired that the aircraft approach the landing area in accordance with current traffic patterns. If clearance to enter traffic pattern is not appropriate for the existing traffic conditions, alternate clearance such as "cleared to land," or "cleared to (specified holding point)," may be issued at the discretion of the controller.

(iii) The clearance to enter traffic pattern should not be confused with the clearance to land since the former is issued when the aircraft is some distance from the field and traffic conditions will not permit the issuance of a landing clearance.

(iv) When it is desired to clear an aircraft to enter a traffic pattern which is not a conventional left-turn pattern, or where more than one pattern exists, the phraseology may be modified to include the designation of the pattern desired. An example for clearance into a right-turn pattern:

"Cleared to enter right traffic pattern."

(3) *Clearance to land.* A clearance to land shall be in the following form:

1. "(Flight identification).
2. "This is (name of tower) tower.[10]
3. "(Position).[11]
4. "At" (altitude).[11]
5. "Cleared to land.
6. "Runway (number of runway in use).[12]
7. "Wind (direction and velocity)." [12]
8. (Any special information).

Example: "Navy seven eight four three cleared to land."

Another example would be when a pilot reports in the control zone as follows:

"Tulsa tower. This is Stinson one two three four, two miles south at eight hundred."

The tower would respond:

"Stinson one two three four. This is Tulsa tower, two miles south at eight hundred. Cleared to land, runway three, wind calm,"

since no previous information concerning traffic direction and runway had been transmitted to this pilot.

(4) *Clearance to taxi.* Clearance to taxi shall be in the following form:

(i) In-bound aircraft:

1. "(Flight identification.)
2. "This is (name of tower) tower.[10]
3. "Cleared to (gate, loading ramp, hangar, parking space, etc.)."
4. (Any special information relative to the use of taxi strips, intersecting runways, obstructions, maintenance operations, or other field activity or condition.)

Example: "United seven cleared to gate five."

(ii) Out-bound aircraft:

1. "(Flight identification.)
2. "This is (name of tower) tower.[10]
3. "Cleared to runway (number of runway
4. "Wind (direction and velocity)."

to be used).

5. (Any special information relative to use of taxi strips, intersecting runways, obstructions, maintenance operations, or other field activity or field condition. Include under this item altimeter setting and time check unless an aircraft operator has indicated in writing to the chief airport traffic controller that this service is not desired.)

Example: "Air force one five two seven cleared to runway three two. Wind northwest one five, altimeter three zero zero four. Time zero nine five six."

(iii) Clearance to taxi from one point to another on landing area:

1. "(Flight identification).
2. "This is (name of tower) tower.[10]
3. "Cleared to (gate, loading ramp, hangar, parking space, etc.).
4. "(Any special information)."

Example: "United thirty-four cleared to hangar four."

(5) *Clearance for take-off.*

(i) Clearance for take-off shall be in the following form:

1. "(Flight identification).
2. "This is (name of tower) tower.[10]
3. "(Any special information).
4. "Cleared for take-off."

Example: "Air Force six seven three four, cleared for take-off."

(ii) When an ATC clearance is required prior to take-off, the take-off clearance described above shall not be issued until such ATC clearance has been transmitted to and acknowledged by the pilot concerned.

(iii) The take-off clearance, as the name implies, is issued after the pilot has taxied to the end of the runway in use, tested his engines, and is ready for take-off. The pilot has previously received information on the runway in use, wind direction and velocity, the altimeter setting, time check, and the appropriate air route traffic control clearance. He is now interested in obtaining authorization to commence his take-off, and he needs information on such local traffic as may affect his flight or which he may approach while in flight within the control zone.

(*a*) Immediately after take-off, many pilots want their time off the ground. When this is requested, it may be given separately in the following form, or combined with a clearance to leave tower frequency:

1. "(Flight identification).
2. "Off at (time—minutes only)."

Example: "American six off at three one."

(6) *Clearance to change frequency.* Normally the pilot of a departing aircraft will guard the control tower frequency until outside the control zone, at which time he may leave the tower frequency without further contact. If, however, a pilot requests approval to leave the tower frequency before he is out of the zone, or if an airport traffic controller desires to authorize a pilot to leave the tower frequency before he is out of the zone, a clearance to leave the tower frequency shall be transmitted in the following form:

1. "(Flight identification).
2. "This is (name of tower) tower."[10]
3. "(Any supplemental information).
4. "Cleared to leave tower frequency."

Example: "Eastern five, this is Washington tower, American seven reported over Mount Vernon four six at two thousand, cleared to leave tower frequency."

(7) *Special clearances.* (i) Clearance to engage in other than routine operations in the control zone shall be in the following form:

1. "(Flight identification).
2. "This is (name of tower) tower.[10]

3a. "Cleared to make right turn."
3b. "Cleared to practice low approach to airport."
3c. "Cleared to Columbus Navy GCA," etc.

Special clearances are provided so that unusual situations, as well as routine range practice, etc., may be properly handled.

(*a*) Phraseologies for certain frequently used special clearances are as follows:

(*1*) Clearance for right turn after take-off shall be at the discretion of the controller. In the event it is not possible to approve the right turn when issuing clearance for take-off, and the pilot has requested such right turn, the following phraseology will be used:

"Will advise later, cleared for take-off."

(*2*) In the event right turn can be approved at the time of issuance of clearance for take-off, the following phraseology will be used:

"Right turn approved. Cleared for take-off."

(*3*) Whenever it is desired that a pilot make a straight-in approach, although

[9a] Words in quotations shall be read as written, accompanied by values required by words in parentheses.

[10] May usually be omitted whenever the aircraft is under direct observation of the airport traffic controller.

[11] May be omitted if the aircraft is in a well-defined traffic pattern.

[12] May be omitted if previously given and no revision is necessary.

he cannot yet be cleared to land, the following phraseology will be used:

"Cleared to make straight-in approach."

(4) In the event aircraft are landing and taking off at an airport without coming to a stop during their landing roll, such operations shall be described as "touch and go" landings. Pilots shall be required to request approval of same by at least the time they are turning on their final approach leg. Approval for such operation shall be issued by use of the following phraseology:

"Cleared to make touch and go landing."

(5) In the event it is not possible to approve such an operation due to other air traffic, the following phraseology shall be used:

"Make full stop landing."

(6) If an aircraft cannot be cleared onto the runway in use or whenever otherwise desired that the aircraft not move, the following phraseology shall be used:

"Hold your position."

(7) If an aircraft can be cleared onto the runway in use but not cleared for take-off, the following phraseology will be used.

"Cleared into position and hold."

(8) When it is desired that a taxying aircraft hold at a specific position, the following phraseology will be used:

"Hold clear of (position)"; or
"Hold on taxi strip."

(9) Whenever pilots have indicated that they are not ready for take-off, although they have taxied onto the landing area, possibly due to their engine temperature being too low, etc., the following phraseology will be used:

"Advise when ready for take-off."

(10) Whenever it is desired that a pilot shorten the downwind leg, the following phraseology will be used:

"Make short approach."

(11) Whenever it is desired that the pilot lengthen the downwind leg, the following phraseology will be used:

"Make long approach."

(12) In the event it is desired to indicate to pilots in the traffic pattern which aircraft they are to follow in the landing sequence, the following phraseology will be used:

"Number (number) to land, follow (type of aircraft) (location of aircraft to follow)." [13]

(13) In the event an aircraft is on final approach and there is still sufficient time to clear a departing aircraft for take-off, the following phraseology will be used:

"Cleared for immediate take-off."

(14) In the event an aircraft is on final approach and there is still sufficient time to clear a departing aircraft which is in take-off position, but some doubt exists as to whether or not the departing aircraft will take off immediately, the following phraseology will be used:

"Take off immediately or clear the runway."

(15) In the event it is believed desirable to advise landing pilots of other aircraft in close proximity to the runway in use, the following phraseology will be used:

"Aircraft to (right or left)," or on "both sides of runway (number)."

(16) In the event an aircraft has encountered landing gear difficulty and has proceeded to close proximity to the control tower for control tower personnel to observe the landing gear, the following phraseology will be used:

(i) If the gear appears to be in a normal position to the control tower personnel:

"Landing gear appears to be down and in place."

(ii) If it does not appear to be normal a description of the appearance should be given, such as:

"Right wheel is retracted"; or "Left wheel does not appear to be in place."

(17) If an aircraft cannot be cleared to land and it is desired that it continue to circle the field, the following phraseology will be used:

"Circle the field."

(18) When it is desired to delay an aircraft to effect separation and a circle of the field would take more than the required time, the following phraseology will be used if circumstances permit:

"Make a short circle to your (right or left) from present position."

(19) When an aircraft is on final approach and it becomes necessary to cancel the landing clearance, the following phraseology will be issued:

"Pull up and go around."

(c) *Description of essential local traffic.* Essential local traffic shall be described so as to facilitate recognition by pilots, as follows:

(1) Military traffic: Military traffic shall be described by one of the following service classifications: "Bomber," "Transport," "Observation," "Primary trainer," "Basic trainer," or "Fighter." When describing "Transport" aircraft the name of the service shall be used preceding the word "Transport," as for example, "Navy transport." Jet propelled aircraft shall be so described.

(i) Military traffic may be described by military type designation to military and other pilots known to be familiar with such designations. The military type designation of military aircraft shall be spoken as a group figure (instead of a serial figure) in radiotelephone communications in accordance with the following examples:

"P forty."
"B seventeen."
"C fifty-four."
"PBY."
"SNJ."
"TBF."

(2) Air-carrier traffic:

(i) Air carrier traffic shall be described to air carrier pilots by use of the abbreviated name of the air-carrier operator, followed by the trip number. Examples:

"American fifteen."
"United six."

(ii) Air-carrier traffic shall be described to other than air-carrier pilots as described above, except that the name of the aircraft shall be used in lieu of the trip number. Examples:

"American DC-4."
"Mid-Continent DC-3."

(3) Civil nonscheduled traffic: Civil nonscheduled traffic shall be described by at least the name of the manufacturer. The model, type, or color of the aircraft also may be used to facilitate identification. Examples:

"Waco-cabin."
"Beechcraft."
"Green Stinson," etc.

(d) *Phonetic alphabet.* (1) When necessary to identify any letter of the alphabet the standard phonetic alphabet is to be used. This alphabet is listed below:

Letter:	*Spoken as*	Letter:	*Spoken as*
A	"Able."	N	"Nan."
B	"Baker."	O	"Oboe."
C	"Charlie."	P	"Peter."
D	"Dog."	Q	"Queen."
E	"Easy."	R	"Roger."
F	"Fox."	S	"Sugar."
G	"George."	T	"Tare."
H	"How."	U	"Uncle."
I	"Item."	V	"Victor."
J	"Jig."	W	"William."
K	"King."	X	"X-ray."
L	"Love."	Y	"Yoke."
M	"Mike."	Z	"Zebra."

(e) *Statement of figures in radiotelephone transmissions.* (1) *Statement of figures to indicate ceiling heights, flight levels, and upper air levels.* These figures, in numbers smaller than 12,000, shall be spoken in even hundreds and thousands of feet. These figures in the number 13,000 and larger numbers shall be spoken as for example, "one three thousand." Examples follow:

Number:	*Statement*
500	"Five hundred."
1,300	"One thousand three hundred."
4,500	"Four thousand five hundred."
10,000	"Ten thousand."
12,000	"Twelve thousand."
13,000	"One three thousand."

(2) *Statement of serial figures.* All figures, other than the types listed in § 26.26-64 (b) (3) (i), (ii), and subparagraphs (1) and (4) of this paragraph, shall be spoken individually. Examples:

Number:	*Statement*
18143	"One eight one four three."
26075	"Two six zero seven five."

The above includes aircraft identification numbers. A Waco, NC1746 would be identified as, for example, "Waco one seven four six."

(i) The figure "0" shall be spoken "zero" when its occurs alone or in a group of figures other than those described in § 26.26-64 (b) (3) (i), (ii) and in subparagraphs (1) and (4) of this paragraph.

[13] When describing location, description such as "to your right," "above you," "one mile ahead of you," etc., is much more satisfactory than "north of you," "one mile east of you," etc.

(3) Time shall be stated in exactly four figures (except as noted in (i) of this subparagraph) utilizing the 24-hour clock basis. The hour shall be stated by the first two figures and the minutes by the last two figures. Examples:

Time:	*Statement*
0000 (Midnight)	"Zero zero zero zero."
0920 (9:20 a. m.)	"Zero nine two zero."
1200 (noon)	"One two zero zero."
1643 (4:43 p. m.)	"One six four three."

(i) Time may be stated in minutes only (two figures) in airport traffic control radiotelephone communications when no misunderstanding is likely to occur.

(ii) Time shall be stated to the nearest minute unless a time check is required, in which case the time should be stated to the nearest quarter minute. Example:

11:05.17. "One one zero five and one quarter."

(iii) The 25-hour clock day begins and ends at 0000 (midnight). The last minute of the last hour begins at 2359 and ends at 0000, which is the beginning of the first minute ending at 0001 of the first hour of the next day.

(4) Field elevations shall be stated in feet in accordance with the following examples:

10 feet. "Field elevation one zero."
75 feet. "Field elevation seven five."
583 feet. "Field elevation five eight three."
600 feet. "Field elevation six zero zero."
1,850 feet. "Field elevation one eight five zero."
2,500 feet. "Field elevation two five zero zero."

(f) *Procedures, words and phrases.* (1) The following procedure words and phrases, which have been adopted in the Combined United States-British Radio Telephone Procedure, shall be used in airport traffic control radiotelephone communication when applicable:

Word or phrase	*Meaning*
"Roger"	"I have received all of your last transmission." (Under no circumstances to be used as an affirmative.)
"Acknowledge"	Used by originator. "Let me know that you have received and understand this message."
"How do you hear me?"	Self-explanatory.
"Speak slower"	Self-explanat ry.
"Stand by"	If used by itself means "I must pause for a few seconds." If the pause is longer than a few seconds, or if "Stand by" is used to prevent another station transmitting, it must be followed by the ending, "out."
"Repeat"	Self-explanatory.
"I will repeat"	Self-explanatory.
"Verify"	"Check coding, check text (subject matter) with the originator and send correct version."
"Affirmative"	"Yes."
"Negative"	"No."
"Message for you"	"I wish to transmit a message to you."
"Send your message."	"I am ready for you to transmit."
"Read back"	"Repeat all of this message back to me exactly as received after I have given 'Over'."
"That is correct"	Self-explanatory.
"Words twice"	(*a*) As a request: "Communication is difficult. Please send every phrase twice." (*b*) As information: "Since communication is difficult, every phrase in this message will be sent twice."
"Correction"	"An error has been made in this transmission (or message indicated). The correct version is ______."
"Wrong"	"What you have just said is incorrect. The correct version is ______."
"Break"	"I hereby indicate the separation of the text from other portions of the message." To be used only when there is no clear distinction between the text and other portions of the message.
"Over"	"My transmission is ended. I expect a response from you."
"Out"	"My transmission is ended. I do not expect a response from you."

(g) *Abbreviation for Air Route Traffic Control.* (1) The abbreviation "ATC" will be used to indicate Air Route Traffic Control and/or Air Route Traffic Control centers; example, "ATC clears Eastern four," etc.

(h) *Identification of aircraft at night.* (1) In addition to the prescribed provisions for identification of aircraft in the radiotelephone procedure, further identification and location of aircraft may be established, during the hours of darkness, by requesting the pilot to show a landing light, as "TWA nine show a landing light."

(i) *Radio control of aircraft not transmitter equipped.* In addition to the prescribed radio operating procedure, the following procedure is established for use in connection with control of aircraft in which radio equipment is limited to receivers:

(1) Broadcasts of airport traffic control clearances or information to VFR traffic, requiring acknowledgment from the pilot, shall provide for such acknowledgment in the following manner:

(i) When the aircraft is on the ground within the range of vision of the controller, the pilot shall be requested to acknowledge receipt of the broadcast by movement of ailerons or rudder, whichever action may be observed more readily, as:

"Acknowledge by moving ailerons," or
"Acknowledge by moving rudder."

(ii) When the aircraft is in the air the same purpose will be achieved by including a request to acknowledge receipt of the broadcast by rocking the wings, as:

"Acknowledge by rocking your wings."

(iii) When the aircraft is either in the air or on the ground, during the hours of darkness, the same purpose will be achieved by requesting the pilot to blink his landing lights, as:

"Acknowledge by blinking your landing or navigation lights."

[Supp. 1, F. R. 14, 8341]

§ 26.26–66 *Local traffic information (CAA rules which apply to § 26.26)*—(a) *Essential local traffic.* (1) When operating under visual flight rules it is the responsibility of the pilot to avoid collision with other aircraft. However, due to the restricted space on and around landing areas, it is often essential that traffic information be issued to aid the pilots to avoid collision between aircraft. Essential local traffic shall be considered to consist of the following:

(i) Traffic within the control zone.

(ii) Ground traffic.

(2) Essential traffic within the zone shall include all known traffic in the control zone which might constitute a hazard to the operation of the aircraft concerned.

(3) Essential ground traffic shall include any aircraft, vehicle, or personnel on the landing area or in a designated loading or parking area which might constitute a hazard to the operation of the aircraft concerned.

(b) *Issuance.* (1) Detailed essential local traffic information shall be issued when, in the judgment of the controller, such information is necessary in the interests of safety, or when requested by a pilot.

[Supp. 1, F. R. 14, 3344]

§ 26.26–67 *Information on field conditions (CAA rules which apply to § 26.26)*—(a) *General.* (1) Essential information on field conditions is information, necessary to safety in the operation of aircraft, which pertains to the landing area or any facilities usually associated therewith. For example, construction work on a taxi strip not connected to the runway in use would not be essential information to any pilot except one who might wish to taxi in the vicinity of the construction work. As another example, if all traffic must be confined to runways, that fact should be considered as essential field information to any pilot not familiar with the airport. (See fig. 9.)

(2) The following field conditions shall be included as essential field information to all pilots:

(i) Construction work along or near the runway in use.

(ii) Rough portions of the landing area proper whether marked or not.

(iii) Any maintenance apparatus or workmen on or near any portion of the landing area a pilot might elect to use.

(iv) Slippery condition of runways or taxiways.

(v) Snow piled or drifted on the landing area proper, and width and length of cleared runway, if known.

(vi) Failure or irregular functioning of any portion of the field lighting system.

(vii) Aircraft parked close to runways or taxiways.

(b) *Responsibility for notification of field conditions.* (1) The agency which operates the airport shall be responsible for notifying the chief airport traffic controller of current field conditions.

(c) *Description.* (1) Information on field conditions shall be stated concisely and clearly. Examples:

1. "Mower on west side of field."
2. "Construction work on north end of field."
3. "Repair trucks near center of field."

(d) *Issuance.* (1) Essential information on field conditions shall be given to every pilot concerned, either directly or indirectly, in sufficient time for the pilot to make proper use of such information.

[Supp. 1, F. R. 14, 3344]

§ 26.26–68 *Preventive control (CAA rules which apply to* § *26.26)*—(a) *Description.* (1) "Preventive control" may be defined as a system of control whereby useful preventive advice is given to pilots of aircraft in the air and a routine approval of the pilot's anticipated actions are eliminated. In other words, the pilot is expected to continue flight including landing in a normal manner unless otherwise advised by the airport traffic controller.

(b) *Control of ground traffic.* (1) The airport traffic controller is concerned with the movements of taxying aircraft, personnel, and vehicular traffic in exercising ground control. Taxying aircraft offer the greatest problems, due to the fact that the visibility is so limited in most aircraft while in a taxying position that obstructions such as personnel, vehicles, or other aircraft may not be readily seen even by the most careful pilots. Therefore, the controller must issue explicit warnings as to the proximity of other obstructions for all taxying traffic. This requires that the control of ground traffic be identical with the control of ground traffic previously outlined under § 26.26–62.

(c) *Control zone procedures.* (1) Procedures for controlling traffic within and entering the control zone may be subdivided as follows:

(i) Traffic joining the traffic pattern: Traffic joining the traffic pattern is primarily interested in obtaining information as to field conditions, runway-in-use, and the wind direction and velocity. This information should be given when the aircraft makes its initial radio contact at the contact reporting point, or approximately 15 miles from the airport. It is expected that the pilot of the aircraft joining the traffic pattern will properly space himself so that the proper separation will be maintained on the final glide for landing.

(ii) Traffic in the traffic pattern: The traffic in the traffic pattern must be properly spaced at all times. This may be accomplished by advising one pilot to make a wider turn, and another pilot to make a shorter turn, or any other pertinent information. The aircraft which are actually in the traffic pattern should be aware of the runway-in-use by the time the traffic pattern is entered and, therefore, the only clearances which should be issued to such traffic are those necessary to obtain proper spacing.

(iii) Landing traffic: If the aircraft in the traffic pattern are properly spaced it will be unnecessary to issue detailed clearances to the landing traffic, such as "cleared to land." Rather, only prohibitive signals which will prevent collision will be issued. For example, one of two aircraft on final approach should be advised to "pull up and go around" if their separation is less than the prescribed minimum.

(iv) Taking-off traffic: All taking-off traffic shall be positively controlled inasmuch as such aircraft are taxiing traffic until the actual take-off is commenced.

(d) *Conditions under which preventive control may be applied.* (1) Preventive control has an immediate application at locations which have one or more of the following types of activities:

1. Air Force or Navy primary flying schools.

2. Air Force or Navy transitional training schools.

3. Locally based squadrons or groups of military aircraft.

4. Local civilian operators or schools.

(i) In such cases mutual agreements and arrangements must be made with the responsible heads of these groups prior to the inauguration of preventive control. Such control is not to be employed for transient aircraft.

[Supp. 1, F. R. 14, 3344]

§ 26.26–69 *Authorizing VFR operations in a control zone clear of clouds and/or when the ceiling or visibility is below basic VFR minimums (CAA rules which apply to* § *26.26).* (a) VFR operations (flight "clear of clouds") will be authorized in a control zone if traffic conditions permit, when the official ground visibility is less than 3 miles and/or the ceiling is less than 1,000 feet. (The official weather observation for the airport about which the control zone is centered should be used where observations are made at more than one airport in the zone.)

(1) When ground visibility is less than 3 miles and/or the ceiling is less than 1,000 feet, a traffic clearance must be obtained before flying in the traffic pattern or landing or taking off at an airport in the control zone. When flight visibility is less than 3 miles and/or the ceiling is reported less than 1,000 feet, a traffic clearance must be obtained before flying in the control zone. As a guide for controllers in authorizing local VFR operations (shooting landings, etc.) under these conditions, provisions should be made for the recall of the aircraft flying locally if traffic conditions become too congested to permit continuance of the local flights. The most practical method of doing this is to require the locally fly-

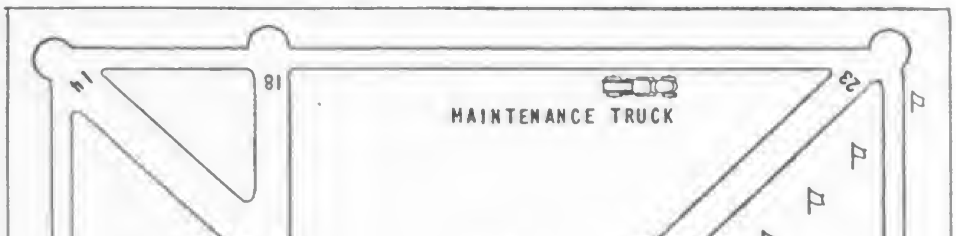


FIGURE 9—Typical airport showing various field conditions.

ing aircraft to be equipped with a functioning receiver and require the pilot to guard the control tower frequency. Thus, the pilot can be recalled or directed away from other traffic as necessary.

(2) VFR operations clear of any cloud formation (less than 500 feet vertically and 2,000 feet horizontally) will be authorized in the control zone provided separation between the VFR aircraft and any IFR traffic flying in such cloud formation is maintained in accordance with IFR separation standards.

(b) *Operation of signal to indicate ground visibility of less than 3 miles and/or a ceiling of less than 1,000 feet.* (1) The following procedures shall be observed when the ground visibility is officially reported to be less than 3 miles and/or the ceiling less than 1,000 feet.

(i) Operate the appropriate light signal.

(*a*) Rotating beacon during daylight hours.

(*b*) Flashing wind direction indicator lights between sunset and sunrise.

(ii) Recall all aircraft operating in the traffic pattern without a clearance.

(c) *Authority for issuance of traffic clearances to VFR operations.* (1) The airport controller shall coordinate with the appropriate center prior to issuing traffic clearances for VFR flight in a control zone at less than the basic VFR weather minimums (500 feet vertically and 2,000 feet horizontally from clouds and 3 miles visibility and a ceiling of 1,000 feet.)

[Supp. 1, F. R. 3345]

§ 26.26-70 *Operating instructions for airport traffic control towers (CAA rules which apply to § 26.26)*—(a) *General*—(1) *Purpose.* The purpose of these instructions is to provide standard operating instructions for all airport traffic control towers. Only the broad phases of operation are included herein and it is expected that each operating agency will provide such additional detailed instructions as are necessary for efficient operation.

(2) *Supervision of towers.* Each operating agency shall establish and designate a person responsible for the supervision and operation of each airport traffic control tower. All other airport traffic control personnel, when on official duty in an airport traffic control tower, will be responsible to and governed by the person in charge. When more than one person is on watch in the tower, one controller shall be designated as the "supervising controller" in charge of the watch.

(b) *Positions of operation*—(1) *General.* Each person on duty in an airport traffic control tower shall, while controlling or aiding in the control of air traffic, occupy one or more positions of operation. These positions of operation shall be established for the purpose of defining specific duties and fixing responsibility for the performance of prescribed functions, and shall be defined as follows:

(i) Local control position: The following are specific duties of this position of operation in addition to such supplementary duties as may be assigned by the chief controller:

(*a*) To issue airport traffic control clearances and information, in accordance with applicable Civil Air Regulations, governing all air traffic and vehicular traffic on the landing area, air traffic departing from the landing area and air traffic operating in accordance with VFR in the control zone.

(*b*) To guard radio frequencies of all aircraft regularly using the landing area and such special frequencies as may be required from time to time.

(*c*) To issue essential local traffic information, as required, to pilots of aircraft taxying on or in the vicinity of the landing area.

(*d*) To furnish to pilots of aircraft taxying on, and in the vicinity of the landing area, information concerning field conditions, altimeter settings, and time checks as required.

(*e*) To forward to the local Weather Bureau office and the appropriate center pilot weather reports as received and reports based upon personal observation of weather conditions from the control tower.

(*f*) To notify operations offices, fire departments, police and ambulance services, as necessary, in the event of an accident or fire on or in the vicinity of the airport.

(*g*) To study and initial all weather reports, notices to airmen, and reports pertaining to the condition of the landing area or tower operating equipment.

(*h*) To operate the appropriate airport lighting facilities as required by aircraft using the airport.

(*i*) To perform the duties of approach control if personnel are not assigned to that position.

(ii) Flight data position: The following are specific duties of this position of operation in addition to such supplementary duties as may be assigned by the chief controller:

(*a*) To assist, as directed by the supervising controller in the issuance of airport traffic control clearances and information and in the operation of control tower equipment.

(*b*) To copy, and relay as necessary, all communication received over the interphone or telephone facilities.

(*c*) To relay air route traffic control clearances and other control messages as instructed by an air route traffic control center.

(*d*) To copy and relay, as directed, reports and information received by radio.

(*e*) To properly post all required flight plans, flight progress reports, arrival reports, and departure reports.

(*f*) To study and initial all weather information and notices to airmen and post such material on the designated board.

(*g*) To provide for the continuous recording of radio transmissions by changing voice records promptly, as they are completed, at locations where voice recorders are installed.

(*h*) To record air route traffic control messages and clearances on appropriate forms.

(*i*) To record flight plans received from pilots (either by radio, interphone, or telephone) on appropriate forms.

(*j*) To maintain airport traffic control operating forms.

(iii) Approach control position: The following are specific duties of this position of operation in addition to such supplementary duties as may be assigned by the chief controller:

(*a*) To direct, under the general supervision of the chief controller, the control activities of a control tower during a tour of duty.

(*b*) To supervise all positions of operation to insure adequate separation between air traffic under the jurisdiction of the tower.

(*c*) To issue air traffic control clearances and information in accordance with applicable Civil Air Regulations, to aircraft which are operating in accordance with IFR under the jurisdiction of the tower.

(*d*) To guard radio frequencies of all aircraft regularly using the landing area and such special frequencies as may be required from time to time.

(*e*) To furnish information concerning field and weather conditions, altimeter settings, and time checks to pilots approaching the landing area.

(*f*) To study and initial all weather reports, notices to airmen, and reports pertaining to the condition of the landing area, associated radio facilities, and tower equipment.

(*g*) To supervise, direct, and train assistant airport traffic controllers and other junior personnel on the same watch.

(iv) Combining positions of operation: When the number of personnel on duty is less than the number of positions of operation outlined above, positions of operation shall be combined in a manner prescribed by the chief controller so as to obtain the highest possible degree of efficiency in operation.

(c) *Radio procedures*—(1) *Guarding radio frequencies.* The supervising controller shall be responsible for maintaining a continuous guard of standard military, naval, and civil aircraft radio frequencies. He shall also maintain a guard, when necessary, on any special frequencies that may be required. The supervising controller shall also provide for the maintenance of a continuous guard of control tower transmissions from any other landing area in the control zone in which he is controlling traffic.

(i) Normally, the volume control on receivers guarding aircraft frequencies shall be adjusted so as to permit the easy reception of normal calls from aircraft over or in the vicinity of all contact reporting points. The volume shall not be reduced on any receiver on which a continuous guard is being maintained, except as follows:

(*a*) The volume on any receiver or speaker may be momentarily reduced to permit the separate reception of transmissions which might be otherwise unintelligible.

(*b*) The volume may be reduced momentarily when transmission from an aircraft might be annoyingly loud because of the nearness of the aircraft.

(*c*) The volume may be reduced when either local or general electrical disturbances make it advisable in order to hear any transmission at all but should be increased to normal volume as soon as possible.

(ii) Tower personnel should check the receivers at least once during each watch to ascertain whether they are operating since failure of this equipment may occur without the knowledge of the personnel on duty. The receiver check may be accomplished by turning the noise suppressor off and increasing the volume until background noise is heard.

(2) *Transmission of radiotelephone messages.* An airport traffic controller on duty shall be responsible for all radiotelephone transmissions emanating from the position, or positions, of operation under his jurisdiction.

(i) The following types of radiotelephone messages shall ordinarily be transmitted by the local control position:

(*a*) Airport traffic control clearances and instructions.

(*b*) Essential traffic information.

(*c*) Field conditions, altimeter settings, and time checks.

(*d*) Any message pertaining to safety of aircraft.

(*e*) Instructions to radio equipped vehicular traffic on the landing area.

(ii) The following types of radiotelephone messages may be transmitted by the flight data position at the discretion of the supervising controller:

(*a*) Relay of air route traffic control clearances and control messages.

(*b*) Acceptance and confirmation of flight plans filed by radio.

(*c*) Any other message authorized by the supervising controller.

(iii) The following types of radiotelephone messages may be transmitted by the approach control position to holding and approaching aircraft operating on an instrument flight plan after such aircraft have been assigned to the tower:

(*a*) Clearances and instructions.

(*b*) Essential traffic information.

(*c*) Field and landing conditions, altimeter settings, and time checks.

(*d*) Any message pertaining to safety of aircraft.

(3) *Relaying information or advice not directly associated with traffic control.* In addition to traffic control communications which are associated with prevention of collision between aircraft within the control zone, the following communications are authorized for handling by an airport traffic controller:

(i) Messages pertaining to the operation of the aircraft authorized for transmission by the commanding officer or the representative of the airport management.

(ii) Messages pertaining to the operation of the aircraft authorized for transmission by a representative of an aircraft operator to the aircraft of such operator.

(iii) Any message pertaining to safety of aircraft.

(d) *Operation of interphone facilities*—(1) *General.* Interphone facilities are maintained to provide rapid voice communications service between agencies for the exchange of information pertinent to the control of air traffic.

(i) The interphone system is divided into two categories: "local" circuits, which may consist of individual circuits between airport traffic control towers and various agencies in the vicinity, or may consist of a single circuit connecting all the agencies in the immediate vicinity of an airport; and "long line" circuits, which may connect two or more widely separated communications stations, towers, operations offices, and air route traffic control centers.

(ii) An airport traffic control tower shall be the coordinating office of any local interphone system originating in the control tower. If such system also serves an airway communications station, coordination shall be effected jointly by both the station and tower.

(2) *Communications authorized for transmission on interphone systems.* Interphone systems are maintained to permit the rapid handling of communications required to effect the control of air traffic. Authorized communications are those required for the control and safety of air traffic. A partial list of authorized material follows in the general order of importance. Priority shall be determined by the relative importance of a message to the control of air traffic, rather than by strict adherence to the order as listed herein.

(i) Emergency communications are communications concerning accidents, suspected accidents, and situations directly endangering life and property. Communications relative to accidents may be continued until essential information has been transmitted to all concerned, but shall not receive emergency classification after the emergency period has passed.

(ii) Movement and control messages and plain English equivalents of "Q" signals pertaining to aircraft movements shall receive priority over other than emergency communications.

(*a*) When two or more movement or control messages are on hand for transmission their priority shall be in the following order, except that the order may be modified by consideration of the time element involved and their relative importance to the control of air traffic:

1. Clearances and control instructions.
2. IFR movement messages:
   a. Flight plans;
   b. Progress reports;
   c. Arrival reports.
3. VFR movement messages.

(iii) Notices to airmen: Each control tower shall compile a list of local aids to air navigation which may affect its operations. Malfunctioning of such aids shall be reported to the appropriate communications station for issuance of a notice to airmen and to the appropriate center for information.

(3) *Interphone operating procedures.* Conversations shall be as brief and concise as possible without undue hesitation and in a uniform flow of language. Every effort shall be made to enunciate clearly and distinctly, paying special attention to numerals. Use of such words as "guess" and "think" is undesirable.

(i) When any doubt exists concerning the accuracy of a received message, the complete message or the essential parts should be repeated back to the sender for verification. Transmitting personnel may also request that a message be repeated back by the receiving personnel.

(ii) "Q" signals shall be transmitted by means of their plain English equivalents. Station identifications shall not be spelled, but the name of the location spoken.

(iii) Low priority traffic may be interrupted for the transmission of high priority traffic, not subject to delay. For example, the continuous transmission of a series of flight plans may be interrupted for the transmission of a traffic control clearance.

(iv) The domestic phonetic alphabet should be used to indicate single letters, initials, or for spelling words whenever similar sounds or difficulties in transmission make such use necessary.

(v) When the origin and destination of a message are on the same circuit, the message shall be filed with the air route traffic control center, which will then make delivery to all concerned. However, local arrangements may be made with the appropriate air route traffic control center to depart from this principle when desired.

(vi) Operating initials: All personnel using interphone circuits shall use two-letter operating initials. The first and last initials of the operator's name should be used when appropriate. Any two letters, however, may be used to avoid confusion due to similarity of sounds. Letters having similar sounds, such as "B" and "P" and letter combinations which are difficult to pronounce should be avoided.

(4) *Methods of originating and completing interphone contacts.* The following outlined procedures and phraseologies shall be used when initiating and completing contacts on standard interphone facilities:

(i) Voice calls and answers: Drops on the long-line interphone system shall be known by the name of the location followed by the name or standard abbreviation of the organization or facility. (On local interphone circuits, the "location" may be omitted.) Examples:

"Memphis control."
"Westover tower."
"Patterson operations."
"Norfolk Navy tower."
"Fort Wayne TWA."
"Casper radio."

(*a*) Initiate the call by use of prescribed procedures. If voice signaling is used, state the voice call of the organization desired, followed by the word "from" and the voice call of the organization calling.

(*1*) All calls shall be answered by stating the voice call of the organization answering the call.

(*2*) Each communication shall be preceded by a term indicating the type of message to follow, such as "flight plan," "clearance," "arrival," "progress report," etc. Messages of an emergency nature shall be preceded by the word "emergency." In voice signaling the descriptive term shall be incorporated in the call, as the last item of the call.

(*3*) Each message shall be terminated by the operating initials of the transmitting personnel.

(*4*) Personnel shall acknowledge receipt of messages by stating their operating initials.

(5) All contacts are completed by air route traffic control center personnel, by stating the time in two figures to the nearest minute.

Example: (Mechanical signaling (inbound to center)).
(Center): "Cleveland control (answering mechanical signaling)."
(Tower): "Buffalo tower, arrival report."
(Center): "Go ahead."
(Tower): "(Proceeds with message), JL".
(Center): "HN, four six."

(b) Except in the transmission of "emergency" messages, continuous calling should be tempered by good judgment. Stations should realize that air route traffic control centers often have only one person assigned to answer calls on two or more circuits. Air route traffic control centers should understand that communications stations, towers and operations office personnel are often engaged in duties such as weather observations, radio contacts, or outside telephone calls, which may delay the answering of interphone calls.

(5) *Connection of circuits.* Circuits will be connected only upon request or approval being received from an air route traffic control center, except that circuits may be connected at the request of a communications station or control tower adjacent to a control boundary, so located that a connection is necessary in order to communicate with the adjacent air route traffic control center.

(i) Request for connection of circuit shall be made in accordance with the following:

"Fresno radio. This is Burbank control; connect Oakland control."
(Fresno signals Oakland control and connects circuits. Message is completed in accordance with standard procedures.)
"Fresno radio. This is Burbank control; release Oakland control."
(Fresno disconnects circuits.)

(6) *Reporting arrivals and departures.* The times of arrival and departure of all aircraft for which flight plans or clearances have been received, shall be reported promptly to the appropriate air route traffic control center or communications station.

(i) The times of arrival and departure as required above shall be exact as established upon the following basis:

(*a*) Arriving aircraft shall be reported as "arrived" at the time the wheels touch the ground and it is apparent that the landing will be completed.

(*b*) Departing aircraft shall be reported as "departed" at the time the wheels leave the ground.

(7) *Relaying position reports from pilots of aircraft en route.* Normally, pilots of aircraft en route will make position reports to United States interstate airway communications stations, Air Force or Navy communications stations, or private facilities. While pilots should be encouraged to continue this practice, airport traffic controllers shall not hesitate to relay such reports when they are addressed to the control towers. Pilots shall be referred to other communications agencies only if the service they request or need can be obtained in no other manner.

(8) *Relaying reports on condition of field or associated facilities.* When abnormal conditions concerning facilities which are pertinent to safety in the operation or traffic control of aircraft are observed by an airport traffic controller or are brought to the attention of the controller, such information shall, if warranted, be forwarded to the appropriate operations office, Civil Aeronautics Administration communications station and, if advisable, to the air route traffic control center within whose control area the tower is located.

(e) *Operation of field lighting system.* (1) Boundary and obstruction lights and the rotating airport beacon shall be lighted continuously between sunset and sunrise, and in addition, the rotating beacon shall be lighted as necessary during the hours of daylight to indicate restriction of VFR operations within the control zone. At airports where no boundary lights are installed (or when boundary lights are inoperative), runway lights on the runway most nearly aligned with the wind, or the "calm wind" runway when appropriate, shall be lighted between sunset and sunrise.

(i) The commanding officer of a military establishment may establish hours of operation of the field lighting system not in accordance with the above. In such cases the commanding officer shall assume the responsibility for such operations.

(2) Floodlights and runway lights: Floodlights and runway lights, except as outlined above, shall be used in accordance with the following:

(i) As soon as the pilot of an aircraft is cleared to taxi out, the taxiways which he is to use shall be illuminated and as the pilot approaches the take-off position, the runway lights for the runway in use shall be switched on. The floodlights shall not be turned on until the pilot has taxied onto the runway and is facing the direction for take-off. The floodlights and the runway lights shall not be turned off until the pilot has cleared the edge of the field or requests that they be turned off.

(ii) When a pilot is approaching to land, the runway lights shall be turned on as soon as the pilot reports in the control zone. The floodlights for the runway in use shall be lighted as soon as the aircraft is identified near the field unless the pilot requests that they be left off. In the latter event they shall be lighted briefly, before the aircraft enters the landing glide, to ascertain that the landing area to be used is clear of obstacles. If the floodlights are used for a landing, they shall not be turned off before the pilot has turned onto a taxi strip, or intersecting runway, unless it is necessary for the pilot to taxi toward an unshadowed floodlight unit.

(iii) As far as practicable, the airport traffic controller shall light only those portions of intersecting runways and taxi strips which the pilot must use in taxiing to the administration building, hangar line, or parking area.

(f) *Altimeter settings*—(1) *Recording and using altimeter settings.* The "altimeter setting" issued by the weather reporting station at 0130, 0730, 1330, and 1930 eastern standard time shall be recorded on a suitable altimeter record form. Immediately thereafter, provided that the average wind velocity does not exceed 45 miles per hour, the knob on the tower altimeter shall be turned until the reading on the barometric scale is exactly the same as the official altimeter setting. The "height setting" shall also be recorded and this will be used for reference data until the next official altimeter setting is received from the weather reporting station. In the event the average wind velocity at the stated hours exceeds 45 miles per hour, the instructions relative to turning the knob on the altimeter and determination of the height setting will not be effective and the previously determined height setting will remain in use until a height setting can be obtained when the average wind velocity is less than 45 miles per hour.

(i) When the existing altimeter setting is requested by a pilot, the airport traffic controller shall turn the knob of the altimeter until the hands of the instrument indicate the same altitude as the last determined height setting. The existing altimeter setting will then be indicated on the barometric scale of the altimeter.

(ii) Whenever adjusting the altimeter to obtain a reading, the vibrator shall be operated so as to eliminate any lag in movement of the altimeter needle.

(iii) Pressure-altitude, when required, shall be obtained from a table of altimeter settings and pressure altitudes compiled for the local landing area. If no such table is available, the pressure altitude may be obtained in the following manner:

(*a*) Determine the existing "altimeter setting."

(*b*) From NACA Report No. 538, Altitude-Pressure Tables Based on the United States Standard Atmosphere, or similar tables, obtain the altitude corresponding to the existing altimeter setting.

(*c*) Add the altitude obtained from the altitude-pressure table to the field elevation. The algebraic sum will be the "pressure-altitude."

(iv) At locations where approach control procedures have been established, the current altimeter setting shall be issued to the aircraft by the control tower in the initial contact if the aircraft is being controlled in accordance with the Standards for the Control of Instrument Flight Rule Traffic.

(g) *Visual reporting zone.* (1) It shall be the responsibility of all airport traffic controllers to be fully apprised concerning exact locations of prominent landmarks which may be used by pilots as visual reporting points upon entering a reporting zone of 15 miles radius surrounding the airport. (See Fig. 10.)

(h) *Reporting information concerning aircraft in difficulty, aircraft accidents, and known hazardous conditions of flight.* (1) Whenever information becomes available to an airport traffic controller concerning aircraft in difficulty, an aircraft accident, or known conditions which are or may be hazardous to aircraft operations, such information shall be reported immediately to the air route traffic control center within whose control area the tower is located, to the airway communications station at the same location as the tower and to the local military offices if appropriate. The control tower shall render every possible assistance to the aircraft involved.

(i) In the event military aircraft are reported to be in difficulty, the airport traffic controller will also notify the local operations office and such other local military offices as the commanding officer may specify.

(2) *Local airport emergency procedures.* Appropriate written operations instructions covering in detail local airport emergency procedures shall be prepared by competent authority. These instructions shall clearly define the duties of airport traffic control personnel during emergency conditions, such as the invoking of crash procedures for an aircraft accident on the landing area, and shall be prepared in collaboration with a representative of the agency which operates the airport (airport manager or commanding officer, or both).

(3) *Reporting imminent and unexpected weather changes.* An airport traffic controller shall assist the local Weather Bureau observer by calling to his attention:

(i) Any differences between the actual weather conditions as observed from the tower and those indicated by the current report, and

(ii) Imminent changes in the weather whenever, because of their unexpectedness, there is some likelihood that they may not be observed immediately by the regular Weather Bureau personnel.

(4) *Dissemination of weather information observed by airport traffic control tower personnel.* Airport traffic control tower personnel may transmit to pilots and air route traffic control centers, without prior reference to the United States or service weather bureau, elements of weather information which can be directly observed in control tower by means of instruments, such as wind direction, wind velocity, and altimeter settings.

(i) The airport traffic control tower personnel may not transmit any observed elements of weather information requiring judgment of the observer, as to value, such as ceiling, amount of cloudiness, and visibility, unless such weather report has either been composed or verified by the United States or service weather bureau, or unless the controller is acting as an official weather observer and is properly certificated for the elements being reported.

(ii) Airport traffic control tower personnel may advise an air route traffic control center of observed weather information simultaneously with advising the Weather Bureau by means of conference on the interphone circuit.

(iii) The airport traffic controller may advise the appropriate center or pilots of observed weather in general terms, such as "thunderstorm east of the field," "large breaks in the overcast," "visibility is lowering to the west," or any other such general statements which do not give actual values of the elements. In such cases the United States or service weather bureau station shall also be advised of such information.

(iv) Airport traffic control tower personnel shall secure weather information, for use in responding to requests from pilots, from the nearest Weather Bureau station or from official weather reports. In no case shall one tower request distant weather information from a distant tower via long line interphone for transmission to pilots when such information is available from an official source at the location desiring the information.

(v) In order that the best possible visibility reports may be given to pilots in the vicinity of an airport, visibility observations will be taken from the control tower durng periods when the visibility is less than 3 miles. Such observations will be taken by Weather Bureau personnel when available, and by control tower personnel when Weather Bureau personnel are not available. Stations where airway communications station personnel make airway observations will be considered as stations where Weather Bureau personnel are not available for assignment to the tower.

(*a*) Control tower personnel who make official visibility observations must be properly certificated by the Weather Bureau.

(*b*) Whenever the visibility is reduced to less than 3 miles and this is first noted by control tower personnel, the Weather Bureau shall be notified immediately by interphone or other appropriate means.

(*c*) The Weather Bureau, upon notification or observation of a visibility of less than 3 miles, will assign an observer to the control tower if sufficient personnel are available. In the event that Weather Bureau personnel are not available, the Weather Bureau will notify the control tower to assume the duty of taking visibility observations.

(*d*) When the visibility has risen to 3 miles or more and indications are that it will remain 3 miles or more for an appreciable period, visibility observations shall revert to the Weather Bureau office. The Weather Bureau office shall be so notified by the Weather Bureau observer in the tower or the airport traffic controller.

(*e*) A record shall be maintained in the control tower on Weather Bureau Form 1130 of all visibility observations made from the control tower including the times of such observations. Each time observational duties are transferred from the Weather Bureau to the control tower or returned, or transferred from one observer to another in the control tower, the time and the initials of the observers involved shall be recorded on Form 1130 in the control tower and on the similar Form 1130 in the Weather Bureau. Completed Forms 1130 will be forwarded to the Weather Bureau office at the end of each month.

(5) *Reporting failure or irregularity of operation of equipment.* The airport traffic controller on duty shall immediately report any failure or irregularity of operation of any apparatus, light or other device, used in controlling airport traffic as directed by competent authority.

(i) Competent authority shall be responsible for the issuance, through the adjacent communications station, of a suitable notice to airmen relative to any failure or irregularity of equipment which affects operation of the airport traffic control tower.

(6) *Maintaining file of permanent records of tower transmissions.* A file of permanent records of control tower radio transmissions shall be maintained where permanent-type recorders are furnished for this purpose. Completed records shall be filed chronologically and indexed for easy reference. Records may be disposed of only as prescribed by the operating agency.

(7) *Maintaining traffic tabulation with mechanical traffic counters.* Mechanical counters are normally used to record the number of local aircraft operations. However, where sufficient counters are provided, a tabulation of other types of operation may be so maintained.

[Supp. 1, 14 F. R. 3345]

Approach control—Fan marker approach procedures.

§ 26.26–81 *General (CAA rules which apply to § 26.26).* (a) Approach control is a service whereby airport traffic control towers issue traffic clearances to aircraft being controlled in accordance with IFR standards by communicating directly with pilots over the voice feature of the radio range, ILS localizer, or over a very high frequency channel of the control tower. Direct communications between the approach controller in the tower and the pilot who is flying under instrument conditions eliminates the communications lag previously encountered, with a resultant saving in time for each instrument approach made. Coordination of traffic arriving and departing during adverse weather conditions is vested in the approach controller who is in a position to see the airport and aircraft in the vicinity and is therefore able to take advantage of every opportunity to safely expedite the flow of traffic on and around the airport. Control tower personnel can view the actual weather conditions and direct traffic to take advantage of breaks in clouds or other changes in weather conditions. (See fig. 11.)

[Supp. 1, 14 F. R. 3349]

§ 26.26–82 *Communications procedures (CAA rules which apply to § 26.26)*—(a) *Holding pattern.* (1) Under approach control procedures, aircraft will be cleared by the center to a holding fix (fan marker or other radio fix) with appropriate holding instructions. Instructions to hold "until further advised by (name of) approach control on (frequency)" are included so that the pilot will know on which frequency he will receive further clearances. The pilot is expected to establish communication with the approach controller when he arrives over the specified holding point, or at an earlier time if specified in his clearance.

(b) *Communications contacts.* (1) The following communications contacts are expected of the pilot under approach control procedures:

(i) Report to Approach Control the time and altitude of reaching the holding fix to which cleared by the center.

(ii) Report when vacating any previously assigned flight level for a newly assigned level.

FIGURE 10—Report over a contact reporting point, and clearance to enter traffic pattern.

(iii) Report when leaving the holding fix in-bound.

(iv) Advise Approach Control if contact approach is to be made.

(c) *Communications channels.* (1) When the voice feature of the radio range is being used for approach control communications and the pilot desires to listen to the navigational feature while executing an instrument approach, he may filter out the voice channel during his final approach. If the controller wishes to contact the pilot during this period, the attention signal of the range will be operated to indicate to the pilot that a message follows.

(2) Pilots should maintain communication by listening on the approach control frequency until cleared to change to the local control frequency (278 kc. or equivalent), or to the appropriate ground control frequency. (Note: VHF-equipped aircraft may be permitted to remain on the approach control frequency until landed, if the traffic load permits.)

(3) All clearances to departing aircraft (taxi clearances, wind direction and velocity, time check, altimeter setting, runway number, airway traffic control clearance, etc.) will normally be issued by the tower on the appropriate ground control frequency. If necessary, the tower may request the pilot to guard the approach control frequency after take-off for additional information.

[Supp. 1, 14 F. R. 3350]

§ 26.26-83 *Control procedures (CAA rules which apply to § 26.26)*—(a) *Control of holding aircraft.* (1) A fan marker (or other radio fix) located on the approach course of a radio range is utilized as a holding fix. Aircraft are stacked vertically at successive 1,000-foot levels, the lowest holding level being at least 1,000 feet above terrain, or the minimum instrument altitude, whichever is higher.

(2) Altitude separation is maintained throughout the approach sequence.

(3) Arriving aircraft will be cleared by the appropriate center to hold at an assigned altitude at the holding fix on the approach course of the radio range serving the airport of intended landing. Thereafter the control tower concerned will issue clearances to the pilots involved.

(4) In the event the holding fix is not received and the pilot has not received clearance for final approach, the last assigned altitude will be maintained to the radio range station and pilot should request further clearance.

(5) Each pilot in the approach sequence shall be given advance notice as to the time he should leave the hold-

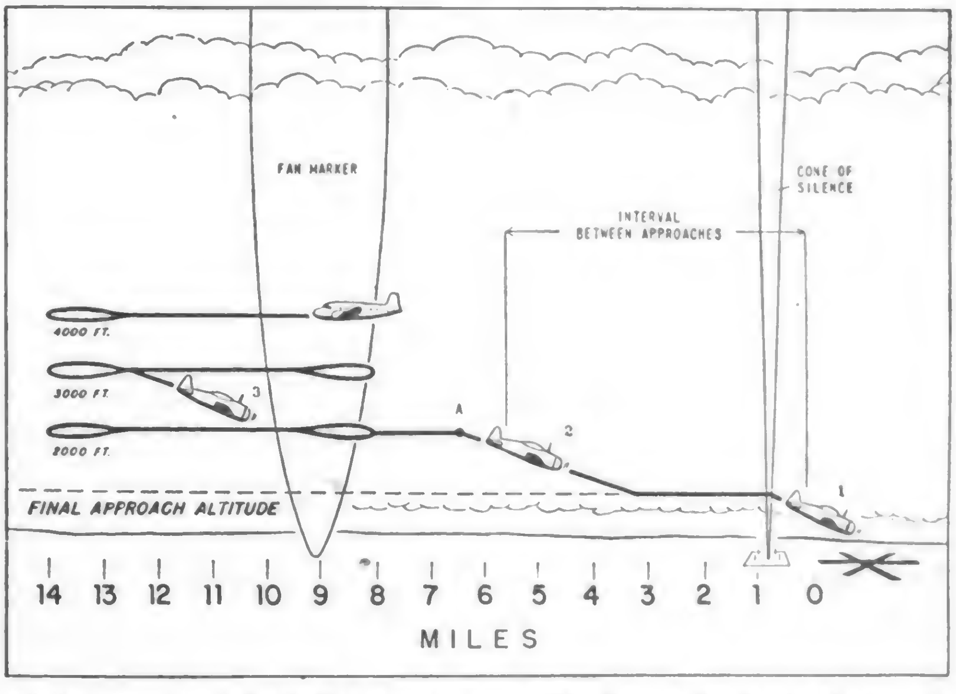


FIGURE 11.—Above diagram shows an aircraft holding at 4,000; No. 3 leaving 3,000 as instructed when No. 2 reported leaving 2,000; No. 2 has left fan marker at designated time maintaining 2,000 until approach clearance received (point A) where descent was started; No. 1 has been sighted, enabling the approach controller to clear No. 2.

ing marker on approach to the airport. The pilot should then arrange his flight path so as to leave the marker exactly at the designated time. Departure should be made at the designated time without further clearance from the tower, maintaining the last assigned altitude.

(6) When the reported ceiling is below the initial approach altitude authorized over the radio navigation facility at the point of intended let-down, the reported ceiling and visibility shall be included by the tower in the initial transmission to the aircraft and revised as necessary.

(b) *Control of approaches.* (1) The first aircraft will leave the holding fix at the time designated, and will commence descent when cleared for a straight-in approach to the airport. Normally the clearance to land will be issued at the time aircraft report contact or are sighted by the tower.

(2) The second aircraft will be instructed to descend to the altitude previously held by the first aircraft after the first aircraft has reported vacating that altitude.

(3) The second aircraft will be instructed to leave the holding fix at a specified time (determined by the shortest time interval between approaches the controller considers practicable), and to maintain the last assigned altitude. This aircraft will then be cleared for an approach (descent) when the preceding aircraft is sighted by the tower and reasonable assurance exists that a normal landing can be made. In some instances, approach clearance may be issued a minute or two after the aircraft has departed from the holding fix.

(4) The aircraft at the lowest holding altitude need not be held at the marker until the preceding aircraft is in sight, but should be given a departure time which will allow the pilot to proceed toward the range station (maintaining his altitude) and still be able to make a normal descent to the airport after approach clearance is received. This procedure will shorten the time interval between successive approaches.

(5) If clearance for approach is not received in sufficient time to permit normal descent, the last assigned altitude should be maintained to the range station and further clearance requested.

(c) *Determination of approach interval.* (1) Determination of the time interval to be used between successive aircraft making final approach is dependent on the speed of the aircraft, prevailing weather conditions and distance from the range station to the airport.

(2) Inasmuch as 1,000-foot vertical separation is maintained between aircraft at all times, the minimum time interval between aircraft cannot be less than 2 minutes if rate of descent is limited to not over 500 feet per minute. If the aircraft will arrive over the range station on instruments, an additional minute may be added to the minimum time interval to allow the pilot 1 minute of level flight prior to crossing the range station. If weather conditions are such that the pilot is liable to encounter difficulty in completing his landing, however, the time interval is increased sufficiently to allow the first aircraft to land before the second aircraft is cleared for approach.

(3) Succeeding aircraft will be cleared to descend when the next lowest altitude level has been reported vacated.

(d) *Missed approaches.* (1) In the event of missed approach, the pilot should follow missed approach procedures, climbing to missed approach altitude on the appropriate course and request further instructions. Succeeding aircraft of the sequence which have departed from the fan marker would under these circumstances be required to maintain their assigned altitudes and hold between the range station and the holding fix. The center shall be immediately advised of the missed approach and subsequent action coordinated between the tower and center.

[Supp. 1, 14 F. R. 3350]

§ 26.26–84 *Examples of phraseologies (CAA rules which apply to § 26.26)*—(a) *Clearance to holding fix.* (1) Clearance of aircraft to a holding fix (Edgewood) by an airway traffic control center for approach control purposes would be given in the following manner:

"Cessna one two three four cleared to Edgewood; maintain three thousand; hold on west course of Smithville range between Edgewood marker and point two minutes west until further advised by Smithville Approach Control on two five four kilocycles. Expect approach clearance at one six one two."

(2) The pilot would report his arrival over the holding fix to the approach controller in the tower as follows:

"Smithville Approach Control. This is Cessna one two three four, over Edgewood one five five seven at three thousand. Over."

(3) The approach controller in the tower would acknowledge over the voice channel of the radio range (254 kcs.), giving current ceiling and visibility (if required), altimeter setting, time check, and further clearance as necessary.

(b) *Example of control problem.* (1) Assume that three aircraft, Navy 1615 at 2,000 (No. 1), Air Force 1234 at 3,000 (No. 2), and Beechcraft 5678 at 4,000 (No. 3), have arrived at the holding fix (Edgewood) and have reported to the approach controller. Final approach altitude is 1,000 feet. Instructions and reports would be as follows:

Time	Identification	Instructions or reports
16:00	Approach control	"Navy 1615 cleared for straight-in approach to airport, report leaving 2,000 and Edgewood. Runway 36, wind north 8."
16:02	Navy 1615 (No. 1)	"Leaving Edgewood and 2,000 at 02."
16:02	Approach control	"Air Force 1234 descend to 2,000 immediately, maintain 2,000, depart Edgewood in-bound at 16:07, report leaving 3,000 and Edgewood."
16:02	Air Force 1234 (No. 2)	"Leaving 3,000."
16:03	Approach control	"Beechcraft 5678 descend to 3,000 immediately; maintain 3,000, depart Edgewood in-bound at 16:12, report leaving 4,000."
16:03	Beechcraft 5678 (No. 3)	"Leaving 4,000."
16:07	Air Force 1234	"Leaving Edgewood at 07, maintaining 2,000."
16:08		(Navy 1615 is sighted by tower and cleared to land.)
16:08	Approach control	"Air Force 1234, cleared for straight-in approach to airport, report leaving 2,000. Runway 36, wind north 8."
16:09	Air Force 1234	"Leaving 2,000."
16:09	Approach control	"Beechcraft 5678 descend to 2,000 immediately, maintain 2,000, report leaving 3,000 and Edgewood."
16:09	Beechcraft 5678	"Leaving 3,000."
16:12	Do	"Leaving Edgewood at 12, maintaining 2,000."
16:13		(Air Force 1234 is sighted by tower and cleared to land.)
16:13	Approach control	"Beechcraft 5678, cleared for straight-in approach to airport, report leaving 2,000. Runway 36, wind north 8."
16:13	Beechcraft	"Leaving 2,000."
16:18		(Beechcraft 5678 sighted by tower.)

In the above example, although each aircraft required 6 minutes to proceed from the marker to the airport (in sight of tower), the interval between successive approaches was only 5 minutes. The aircraft at the lowest holding altitude need not be held at the marker until the preceding aircraft is in sight. See text § 26.26 (b) (4).

[Supp. 1, 14 F. R. 3351]

Procedures for alerting search and rescue facilities.

§ 26.26–101 *Introduction (CAA rules which apply to § 26.26).* The purpose of including these procedures in this manual is to insure standard research and rescue alerting procedures on the part of air traffic control. Air traffic control facilities do not have either direct or indirect control of rescue facilities. Therefore, it is necessary to specify air traffic control functions, responsibilities and procedures for alerting such facilities.

(a) *General.* The center, by virtue of the information it possesses regarding movements of aircraft, shall serve as the central point for the coordination of flight data and dissemination of aircraft movement information regarding air traffic within flight advisory areas.

(1) *Search and rescue.* Search and rescue information shall be provided by air traffic control to assist the associated air rescue agency by advising of aircraft believed, or known to be in need of rescue assistance by supplying pertinent information in relation to last known position, estimated present position, radius of possible action, position of other aircraft along the route of flight, and by acting as clearing agency for assembling other necessary data.

[Supp. 1, 14 F. R. 3351]

§ 26.26–102 *Safety center (CAA rules which apply to § 26.26).* A safety center, where established, shall consist of an air route traffic control center and a rescue coordination center. The air route traffic control center administers air traffic control and traffic advisory information service, within the limits of its responsibilities, whereas the rescue coordination center will administer the search and rescue service. When not adjoining or when necessary, the air route traffic control center and the rescue coordination center must be connected by telephone, interphone, teletype, or by other means of direct communication.

[Supp. 1, 14 F. R. 3351]

§ 26.26-103 *Alerting of organized search and rescue service (CAA rules which apply to § 26.26).* (a) Where an organized search and rescue service is in operation within a control area of flight advisory area, the notification regarding aircraft in distress shall be forwarded to the appropriate rescue agency by air traffic control. In flight advisory areas, where there is no air traffic control service established, similar action will be taken by the agency responsible for providing flight information service.

(b) Each air route traffic control center shall establish a coordinated plan, with the established rescue coordination center serving the control area of that center, to provide for the effective execution of responsibilities and procedures outlined below:

(1) When assistance to aircraft in distress is required, other than that provided by a flight information service, the rescue coordination center will be responsible for providing that assistance.

(2) When it is determined that an aircraft is in distress, the center having this information will be responsible for immediately notifying the appropriate rescue coordination center. In the event of an aircraft in distress being handled by airport traffic control or approach control, it will be the responsibility of such control to notify the air route traffic control center who will in turn notify the rescue coordination center. This shall not prevent airport traffic control or approach control from alerting local search and rescue agencies or notifying the rescue coordination center direct when the airport traffic control or approach control is not located within a control area.

(3) When an aircraft that is believed to be in distress is under the operational control of an operating agency, the air route traffic control center having this information will advise such operating agency and obtain concurrence that the aircraft is actually in need of assistance prior to notifying the rescue coordination center. However, if it is determined that an aircraft is actually in distress, such rescue coordination center may be advised before notifying the operating agency.

[Supp. 1, 14 F. R. 3351]

§ 26.26-104 *(CAA rules which apply to § 26.26). Alerting procedures.* (a) For purposes of alerting the rescue coordination center, Air Traffic Control will consider aircraft to be in distress under the following circumstances:

(1) When information is received that an aircraft has definitely made a forced landing or is about to do so.

(2) When information is received which indicates that the operating efficiency of an aircraft has been impaired to the extent that a forced landing is likely.

(3) When overdue as defined for the particular route or region concerned.

(b) *Alerting information.* The following information is to be included in the alerting report to the rescue coordination center:

(1) Agency and person calling.

(2) Flight plan of aircraft and color, if known.

(3) Time last transmission received, by whom, and frequency used.

(4) Last position report, and how determined.

(5) Number of persons aboard.

(6) Time fuel expected to be exhausted.

(7) Whether or not two-way communication is available.

(8) Any action taken by reporting office.

(9) Other pertinent remarks.

(c) *Plotting aircraft in distress.* When an aircraft is in distress, the air route traffic control center shall plot the flight on a chart, utilizing previously reported positions and other available information. The probable future positions of the aircraft should be projected thereon as well as the radio direction finding fixes, if available. Positions of other known aircraft operating in the vicinity of the aircraft in distress and their probable future positions should also be plotted. Taking into consideration the known fuel supply, a maximum radius of action from the last known position shall also be plotted. All known information is to be forwarded immediately to the rescue coordination center.

[Supp. 1, 14 F. R. 3351]

§ 26.27 *Relaying information.* An operator shall not relay information or instructions received from airway traffic control personnel, airway communications, or United States Weather Bureau airport stations, otherwise than in the manner approved by the Administrator.

§ 26.28 *Maximum hours.* Except in case of an emergency, a certificated operator shall be relieved of all duty for not less than 24 consecutive hours at least once during each 7 consecutive days, and shall not serve, nor be required to serve as such:

(a) In excess of 10 consecutive hours;

(b) In excess of 10 hours during a period of 24 consecutive hours unless the operator is given a rest period of not less than 8 hours at or before the termination of such 10 hours of duty.

§ 26.29 *Display of certificate.* An operator shall keep his certificate readily available when he is on duty and shall present it for inspection upon request of any officer or employee of the Administrator or Board and of any State or municipal official charged with the duty of enforcing local laws or regulations involving Federal compliance.

§ 26.30 *Medical certificate.* A medical certificate issued by an authorized medical examiner of the Administrator or other evidence satisfactory to the Administrator that the air-traffic control-tower operator has met the physical requirements prescribed in this part shall be carried by such airman while on duty.

§ 26.31 *Equipment standards.* A certificated air-traffic control-tower operator shall not control air traffic with facilities which the Administrator has determined to be inadequate.

§ 26.32 *Inspection.* An applicant or a holder of a certificate or rating, upon reasonable request by any representative of the Administrator, shall cooperate fully in any examination which may be made of him.

§ 26.33 *Surrender of certificate.* Upon the suspension, revocation, or expiration of a certificate, the holder shall, upon request, surrender such certificate to a representative or employee of the Administrator.

§ 26.34 *Periodic physical examination.* The holder of an air-traffic control-tower operator certificate shall not exercise the privileges thereunder unless within the preceding 12 calendar months he has met the physical standards of the Second Class prescribed in Part 29 of this subchapter by passing an examination conducted by an authorized medical examiner of the Administrator.

[Amdt. 26-4, 7 F. R. 5038]

§ 26.35 *Operation during physical deficiency.* A certificated air-traffic control-tower operator shall not serve as such during the period of any known physical deficiency which would render him unable to meet the physical requirements prescribed for the original issuance of his certificate: *Provided,* That if the deficiency is of a temporary nature, he may perform any duties not affected thereby when there is present and on duty another certificated and properly qualified air-traffic control-tower operator.

[Amdt. 26-1, 7 F. R. 6943]

§ 26.36 *Recent experience requirements.* The holder of an air-traffic control-tower operator certificate shall not exercise the privileges thereunder unless:

(a) If rated as a junior air-traffic control-tower operator he has served for at least three months as an operator at the airport to which the rating applies during the twelve calendar months immediately preceding, or

(b) If rated as a senior air-traffic control-tower operator he has served for at least three months as an operator at the airport to which the rating applies during the six calendar months immediately preceding, or

(c) He has demonstrated to the satisfaction of the Administrator that he is able to meet the standards currently prescribed by the regulations of this subchapter for the issuance of the certificate and rating.

[Amdt. 26-4, 7 F. R. 5038]

§ 26.37 *Reports.* The holder of an air-traffic control-tower operator certificate shall furnish the medical examiner, at the time of each physical examination, to be forwarded by him to the Administrator, a report setting forth the amount and type of his aeronautical experience and such other pertinent data as the Administrator may require, since his last preceding medical examination.

[Amdt. 26-4, 7 F. R. 5038]

PART 27—AIRCRAFT DISPATCHER CERTIFICATES

AUTHORITY: §§ 27.1 to 27.33 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 601, 602, 52 Stat. 1007, 1008; 49 U. S. C. 551, 552.

SOURCE: §§ 27.1 to 27.33 contained in Amendment 46, Civil Air Regulations, 5 F. R. 1761, as amended by Amendments 75, 5 F. R. 3946, except as noted following sections affected.

REQUIREMENTS

§ 27.1 *Aircraft dispatcher certificate requirements.* To be eligible for an aircraft dispatcher certificate, an applicant shall comply with the requirements of §§ 27.2–27.8.

§ 27.2 *Age.* Applicant shall be at least 23 years of age.

§ 27.3 *Character.* Applicant shall be of good moral character.

§ 27.4 *Citizenship.* Applicant shall be a citizen of the United States or of a foreign government which grants or has undertaken to grant reciprocal aircraft dispatcher privileges to citizens of the United States on equal terms and conditions with citizens of such foreign government.

[Amdt. 27-2, 13 F. R. 4314]

§ 27.5 *Education.* Applicant shall be able to read, write, and understand the English language, and speak the same without any accent or impediment of speech that would interfere with two-way radio conversation.

§ 27.6 *Aeronautical knowledge.* Applicant shall be familiar with and shall accomplish a satisfactory written examination on:

(a) The provisions of Parts 40 and 61 and those parts of Part 60, of this subchapter, which apply to dispatching. In each case the applicant shall understand the relation of each provision to air carrier operation.

(b) The characteristics of at least one make and model of air carrier aircraft, with particular reference to performance, gross load, pay loads under conditions of various fuel loads, fuel capacity, fuel consumption at specified power outputs at various altitudes, most economical speed at which level flight can be maintained, and loading charts.

(c) The general system of collection and dissemination of weather information.

(d) Weather map, forecast and sequence abbreviations, symbols, and nomenclature. The general principles of modern methods of weather analysis including the application of data obtained from airplane weather observations and meteorological data reported from observations made by pilots engaged in air carrier flights.

(e) Cloud forms, including average heights of their bases and approximate upper and lower limits within which their bases and tops respectively occur.

(f) Weather conditions adversely affecting aeronautical activities, the circumstances under which they occur, how such are ascertained and located, and principles of forecasting such conditions.

(g) The influence of terrain upon meteorological conditions and developments, and the relation thereof to air carrier flight operations.

(h) Elementary principles of radio range operation and radio communication, including weather conditions adversely affecting them and the communication procedures and practices used between airplanes and ground stations.

(i) Department of Agriculture Weather Bureau Circular N, Instructions for Airway Meteorological Service, and all amendments thereto.

(j) Air navigation facilities in use on the civil airways, including rotating beacons, course lights, radio ranges, radio marker beacons and intermediate fields.

(k) Principles of aircraft navigation, with particular respect to instrument operation and use of radio range and direction-finding equipment, including letdown procedures.

(l) Use and limitations of sensitive type altimeters, particularly with respect to barometric settings.

(m) Airway and airport traffic control procedures.

§ 27.7 *Aeronautical experience.* (a) Applicant shall have served in scheduled air carrier or scheduled military operations for 2 of the immediately preceding 3 years as:

(1) A pilot member of the crew; or
(2) A flight radio operator or ground radio operator; or
(3) A flight navigator; or
(4) A meteorologist in a dispatch organization dispatching aircraft; or
(5) A technical supervisor of aircraft dispatchers; or
(6) An assistant in dispatching of scheduled military aircraft; or

(b) Applicant shall have served for 2 of the immediately preceding 3 years as an air traffic controller; or

(c) Any combination of experience in paragraph (a), or in paragraphs (a) and (b) of this section, provided each is at least one year; or

(d) Applicant shall have served as an assistant in the dispatching of scheduled air carrier aircraft under the supervision of a certificated aircraft dispatcher for at least one year within the immediately preceding 2 years; or

(e) Applicant shall be a graduate of an aircraft dispatcher course approved by the Administrator.

[Amdt. 27-3, 11 F. R. 1883, as amended by Amdt. 27-3, 13 F. R. 5329]

§ 27.8 *Aeronautical skill.* Applicant shall be able to:

(a) Make a reasonably accurate and intelligent analysis of a series of daily Weather Bureau maps, in accordance with modern methods, and forecast therefrom the subsequent weather conditions pertinent to air carrier flying operations,

(b) Make an accurate and detailed analysis, in accordance with modern methods, of weather conditions prevailing in the general neighborhood of a specified civil airway from a series of daily Weather Bureau maps and sequence reports, and forecast with a high degree of accuracy subsequent weather trends pertinent to air carrier flying operations, with particular reference to specified terminals,

(c) Be sufficiently familiar with the Morse code to be able to identify radio ranges by their identification signals,

(d) Prepare and use charts to determine the most economical fuel consumption settings of an aircraft at given altitudes, and

(e) Dispatch and assist a hypothetical flight under adverse weather conditions.

AIRCRAFT DISPATCHER CERTIFICATE

§ 27.10 *Application.* Application for an aircraft dispatcher certificate shall be made upon the applicable form prescribed and furnished by the Administrator.

§ 27.11 *Display.* An aircraft dispatcher certificate shall be kept readily available to the holder thereof at all times when he is on duty in connection with the dispatching of air carrier aircraft, and shall be presented upon the request of any authorized representative of the Administrator or Board or of any State or municipal official charged with the duty of enforcing local laws or regulations involving Federal compliance.

§ 27.12 *Duration.* An aircraft dispatcher certificate shall be of 60 days' duration, and unless the holder is otherwise notified by the Administrator within such period, it shall continue in effect thereafter until otherwise specified by the Board, unless suspended or revoked.

[Amdt. 27-8, 7 F. R. 5038]

§ 27.13 *Temporary certificates.* The Administrator or his authorized representative may issue a temporary aircraft dispatcher certificate for a period of not to exceed 90 days, subject to the terms and conditions specified therein by the Administrator.

[Amdt. 27-1, 12 F. R. 4433]

§ 27.14 *Recent experience requirements.* The holder of an aircraft dispatcher certificate shall not exercise the privileges thereunder unless, within the preceding twelve calendar months he has either:

(a) For at least three months,

(1) Served as an aircraft dispatcher, or

(2) Served as first or second pilot in scheduled air carrier operation, or

(3) Been engaged in, (i) the technical supervision of aircraft dispatchers or air carrier dispatching systems, or (ii) the determination of competency or qualifications of aircraft dispatchers, or

(4) Served in any combination of the duties described in subparagraphs (1), (2), or (3) of this paragraph; or

(b) Demonstrated to the satisfaction of the Administrator that he is able to meet the standards currently prescribed by the regulations in this subchapter for the issuance of the certificate and rating.

[Amdt. 27-8, 7 F. R. 5028]

§ 27.15 *Reports.* The holder of an aircraft dispatcher certificate shall transmit to the Administrator, annually, during the month of January, a report for the preceding twelve-month period, setting forth the amount and type of his aeronautical experience and such other pertinent data as the Administrator may require.

[Amdt. 27-8, 7 F. R. 5039]

§ 27.16 *Expired certificates; special issuance.* The holder of an aircraft dispatcher certificate which has expired during the preceding twelve months may obtain a new certificate and the same rating theretofore held immediately prior to its expiration, upon application, by demonstrating to the satisfaction of the Administrator that he is able to meet the standards currently prescribed by the regulations in this subchapter for the issuance of the certificate and rating.

[Amdt. 27-8, 7 F. R. 5039]

§ 27.17 *Nontransferability.* An aircraft dispatcher certificate is not transferable.

§ 27.18 *Surrender.* Upon the suspension, revocation, or expiration of an aircraft dispatcher certificate, the holder thereof shall, upon request, surrender such certificate to any officer or employee of the Administrator.

§ 27.19 *Reexamination.* An applicant for an aircraft dispatcher certificate who has failed to successfully accomplish the prescribed theoretical or practical tests may apply for reexamination at any time after the expiration of 30 days from the date of such failure.

[Amdt. 46; 5 F. R. 1761, as amended by Amdt. 27-1, 10 F. R. 6831]

§ 27.20 *Revocation.* No person whose aircraft dispatcher certificate has been revoked shall apply for or be issued an aircraft dispatcher certificate for a period of 1 year after the revocation, except as the order of revocation may otherwise provide.

[Amdt. 87, 5 F. R. 5256]

EXAMINATIONS AND TESTS

§ 27.30 *General.* The examinations and tests prescribed in this part shall be conducted by an authorized representative of the Administrator.

§ 27.31 *Time and place.* All examinations and tests will be held at such times and places as the Administrator may designate.

§ 27.32 *Inspection.* The applicant for an aircraft dispatcher certificate shall offer full cooperation with respect to any inspection or examination which may be made of such applicant upon proper request by any authorized representative of the Administrator prior or subsequent to the issuance of an aircraft dispatcher certificate.

§ 27.33 *Standard of performance.* All practical or theoretical examinations and tests shall be accomplished to the satisfaction of the Administrator and the passing grade in each subject shall be at least 70 percent.

PART 29—PHYSICAL STANDARDS FOR AIRMEN

AUTHORITY: §§ 29.1 to 29.5 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 601, 602, 52 Stat. 1007, 1008; 49 U. S. C. 551, 552.

SOURCE: §§ 29.1 to 29.5 contained in Amendment 29-0, Civil Air Regulations, 7 F. R. 3925, except as noted following sections affected.

§ 29.1 *Physical standards.* The physical standards for airmen shall be as set forth in §§ 29.2–29.4.

§ 29.2 *First class*—(a) *Eye.* Applicant shall have:

(1) A visual acuity of at least 20/20 in each eye separately without correction: *Provided,* That if the vision in either or both eyes is not poorer than 20/50 and is brought up to 20/20 or better in each such eye by glasses, the applicant may be qualified upon condition that correcting glasses be worn while exercising the privileges of his airman certificate.

(2) An average depth perception of 30 millimeters or less on a prescribed depth perception apparatus with or without correction: *Provided,* That if the depth perception is greater than 30 millimeters without correction, and is corrected to at least 30 millimeters average by glasses, the applicant may be qualified upon condition that such glasses be worn while exercising the privileges of his airman certificate.

(3) No diplopia in any meridian within 35 degrees from the point of visual fixation.

(4) Not more than one diopter of hyperphoria in either eye.

(5) Not more than 10 diopters of esophoria.

(6) Not more than 5 diopters of exophoria.

(7) An abduction of not less than 3 diopters nor more than 15 diopters.

(8) An adduction of 6 or more diopters.

(9) An accommodation of at least V=1.00 at 18 inches with each eye separately without the use of correcting glasses.

(10) Normal color vision.

(11) Normal visual fields.

(12) No acute or chronic pathological condition of either eye or adenexae, which may interfere with its proper function, may progress to that degree, or may be aggravated by flying.

(b) *Ear, nose, throat, and equilibrium.* (1) Applicant shall be able to hear the whispered voice at 8 feet with each ear separately; shall have no acute or chronic disease of the middle or internal ear; no disease of the mastoid; no unhealed (unclosed) perforations of the ear drum; no disease or malformation of the nose or throat which may interfere with or be aggravated by flying; and no disturbance of equilibrium.

(2) If the hearing acuity for the whispered voice is less than 20 feet in either ear the applicant shall possess a hearing acuity of at least 50% of normal in each ear throughout the effective speech and radio range as demonstrated by a standard audiometer.

(c) *General physical condition.* (1) Applicant shall have no organic or functional disease or structural defect or limitation which would interfere with the safe piloting of aircraft, or other duties of his airman certificate.

(2) Reclining blood pressure shall not exceed 135 mm. systolic, nor 90 mm., diastolic.

(3) Applicants 40 years of age or over shall demonstrate a degree of circulatory efficiency compatible with the safe operation of aircraft at high altitudes.

(d) *Nervous system.* Applicant shall have no disease of the mental or nervous system and no abnormality of the personality.

§ 29.3 *Second class*—(a) *Eye.* Applicant shall have:

(1) A visual acuity of at least 20/20 in each eye separately without correction: *Provided,* That if the vision in either or both eyes is not poorer than 20/50 and is brought up to 20/20 or better in each such eye by glasses, the applicant may be qualified upon condition that correcting glasses be worn while exercising the privileges of his airman certificate.

(2) An average depth perception of 30 millimeters or less on a prescribed depth perception apparatus, with or without correction: *Provided,* That if the depth perception is greater than 30 millimeters without correction, and is corrected to at least 30 millimeters average by glasses, the applicant may be qualified upon condition that such glasses be worn while exercising the privileges of his airman certificate.

(3) No diplopia in any meridian within 35 degrees from the point of visual fixation.

(4) Not more than one diopter of hyperphoria.

(5) Properly balanced eye muscles with an abduction of 3 diopters or more, and adduction of six diopters or more.

(6) Sufficient accommodation to pass a test prescribed by the Administrator based primarily upon ability to read official aeronautical maps.

(7) Normal fields of vision; and

(8) No pathology of the eye.

(b) *Ear, nose, throat, and equilibrium.* Applicant shall be able to hear the whispered voice at 8 feet with each ear separately; shall have no acute or chronic disease of the middle or internal ear; no disease of the mastoid; no unhealed (unclosed) perforations of the ear drum; no disease or malformation of the nose or throat which may interfere with or be aggravated by flying; and no disturbance of equilibrium.

(c) *General physical condition.* Applicant shall have no organic or functional disease or structural defect or limitation which would interfere with the safe piloting of aircraft, or other duties of his airman certificate.

(d) *Nervous system.* Applicant shall have no disease of the mental or nervous system and no abnormality of the personality.

§ 29.4 *Third class*—(a) *Eye.* Applicant shall have:

(1) A visual acuity of at least 20/50 in each eye separately without correction: *Provided,* That if the vision in either or both eyes is poorer than 20/50 and is brought up to 20/30 or better in each such eye by glasses, the applicant may be qualified upon condition that such glasses be worn while exercising the privileges of his airman certificate.

(2) No serious pathology of the eye.

(b) *Ear, nose, throat, and equilibrium.* Applicant shall be able to hear the whispered voice at 3 feet; shall have no acute or chronic disease of the internal ear, no disease or malformation of the nose or throat which may interfere with or be aggravated by flying, and no disturbance in equilibrium.

(c) *General physical condition.* No applicant shall have an organic or functional disease which would interfere with the safe piloting of aircraft, or other duties of his airman certificate. Any structural defect or limitation shall be noted on the medical certificate.

(d) *Nervous system.* Applicant shall have no disease of the mental or nervous system and no abnormality of the personality.

[Amdt. 29-0, 7 F. R. 3925, as amended by Amdt. 29-2, 9 F. R. 11675, Amdt. 29-3, 10 F. R. 3795]

§ 29.5 *Waiver of physical standards.* An airman certificate shall be issued to an applicant, other than an applicant for the original issuance of an air-line transport pilot certificate, who does not meet the appropriate physical standards if his aeronautical experience, ability, and judgment compensate for his physical deficiency and he meets all other requirements for the issuance of said certificate. Any certificate issued under these circumstances shall state that the applicant does not meet the appropriate physical standards prescribed herein but that his physical deficiencies were found to be compensated by his demonstrated aeronautical experience, ability, and judgment. Such certificate may be limited as to type of operation, type of aircraft, or period of reexamination.

[Amdt. 29-1, 8 F. R. 16888]

Part 33—Flight Radio Operator Certificates

REQUIREMENTS FOR CERTIFICATE

AUTHORITY: §§ 33.1 to 33.17 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 601, 602, 52 Stat. 1007, 1008; 49 U. S. C. 551, 552.

SOURCE: §§ 33.1 to 33.17 contained in Amendment 33-0, Civil Air Regulations, 12 F. R. 3029, except as noted following sections affected.

NOTE: The following explanatory statement was issued as a part of Amendment 33-0:

In accordance with the provisions of Title VI of the Civil Aeronautics Act of 1938 (52 Stat. 1007; 49 U. S. C. 551-560) it is unlawful for any person to serve in any capacity as an airman in connection with any civil aircraft used in air commerce without an airman certificate authorizing him to serve in such capacity, or in violation of the terms of any such certificate. A flight radio operator falls within the definition of airman as defined in that act.

The purpose of this part is to provide a means for compliance with the airman requirements of Title VI of the act with respect to the use in air commerce of those types of aircraft which require the services of flight radio operators by providing the standards by which flight radio operators may be certificated as airmen.

REQUIREMENTS FOR CERTIFICATE

§ 33.1 *Issuance.* A flight radio operator certificate will be issued to an applicant who meets the following requirements.

§ 33.2 *Age.* Applicant shall be at least 18 years of age.

§ 33.3 *Citizenship.* Applicant shall be a citizen of the United States or of a foreign government which grants reciprocal flight radio operator privileges to citizens of the United States on equal terms and conditions with citizens of such foreign government.

NOTE: At the present time Federal Communications Commission radio operator licenses are issued only to citizens of the United States.

§ 33.4 *Education.* Applicant shall be able to read, write, and understand the English language and speak the same without accent or impediment of speech which would interfere with two-way radio conversation.

§ 33.5 *Physical standards.* Applicant shall meet the physical standards of the third class prescribed in Part 29 of this subchapter of this chapter.

§ 33.6 *Experience.* (a) Applicant shall hold a Federal Communications Commission radiotelegraph operator license of not less than second class.

(b) Applicant shall:

(1) Have had at least 12 months of satisfactory experience as a radio operator in aircraft, maritime, or ground stations, commercial or military, including at least 4 months of experience as a radiotelegraph operator; and have had at least 50 hours of experience in the operation of aircraft radio during flight; or

(2) Be a graduate of a flight radio operator course approved by the Administrator.

§ 33.7 *Knowledge.* Applicant shall pass a written examination on the following subjects:

(a) Such provisions of the Civil Air Regulations (Parts 1-99 of this subchapter) as are pertinent to the operation of aircraft radio systems;

(b) Theory and operation of radio communication and radio navigational systems in general use on aircraft;

(c) Radio navigation of aircraft;

(d) Aircraft radio operating procedures.

§ 33.8 *Skill.* Applicant shall:

(a) Pass a practical examination on the operation, adjustment, and routine repair of aircraft radio communication and radio navigational equipment;

(b) Demonstrate his ability to send and receive International Morse Code at a speed of 20 words per minute code groups, and 25 words per minute plain language.

CERTIFICATION RULES

§ 33.10 *Application.* Application shall be made on a form and in the manner prescribed by the Administrator.

§ 33.11 *Duration.* A flight radio operator certificate shall remain in effect unless it is suspended, or revoked, or a general termination date for such certificate is fixed by the Board.

§ 33.12 *Temporary certificates.* The Administrator or his authorized representative may issue a temporary flight radio operator certificate for a period of not to exceed 90 days, subject to the terms and conditions specified therein by the Administrator.

§ 33.13 *Reexamination.* Applicants who have failed in any examination may apply for reexamination on the part failed after 30 days from the date of such failure.

§ 33.14 *Certificate.* No individual shall serve in the flight crew as a flight radio operator unless he has in his personal possession while so serving a valid flight radio operator certificate issued by the Administrator.

[Amdt. 33-1, 13 F. R. 4759]

§ 33.15 *Medical certificate and renewal.* No individual shall exercise the privileges of a flight radio operator certificate unless he has in his personal possession while so serving a medical certificate or other evidence satisfactory to the Administrator showing that he has met the physical requirements appropriate to his certificate within the preceding 12 calendar months.

[Amdt. 33-1, 13 F. R. 4759]

§ 33.16 *Certificate display.* A flight radio operator shall, upon request, present his airman and medical certificates for examination by any representative of the Civil Aeronautics Board or Administrator or by any State or local law enforcement officer.

[Amdt. 33-1, 13 F. R. 4759]

§ 33.17 *Operation during physical deficiency.* No flight radio operator shall exercise the privileges of his airman certificate during any period of known physical deficiency or increase in physical deficiency which would render him unable to meet the physical requirements prescribed for the issuance of his currently effective medical certificate.

[Amdt. 33-1, 13 F. R. 4759]

PART 34—FLIGHT NAVIGATOR CERTIFICATES

REQUIREMENTS FOR CERTIFICATE

AUTHORITY: §§ 34.1 to 34.17, issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 601, 602, 52 Stat. 1007, 1008; 49 U. S. C. 551, 552.

SOURCE: §§ 34.1 to 34.17, contained in Amendment 34-0, Civil Air Regulations, 12 F. R. 3029.

NOTE: The following explanatory statement was issued as a part of Amendment 34-0:

In accordance with the provisions of Title VI of the Civil Aeronautics Act of 1938 (52 Stat. 1007; 49 U. S. C. 551-560) it is unlawful for any person to serve in any capacity as an airman in connection with any civil aircraft used in air commerce without an airman certificate authorizing him to serve in such capacity, or in violation of the terms of any such certificate. A flight navigator falls within the definition of airman as defined in that act.

The purpose of this part is to provide a means for compliance with the airman requirements of Title VI of the act with respect to the use in air commerce of those types of aircraft which require the services of flight navigators by providing the standards by which flight navigators may be certificated as airmen.

REQUIREMENTS FOR CERTIFICATE

§ 34.1 *Issuance.* A flight navigator certificate will be issued to an applicant who meets the following requirements.

§ 34.2 *Age.* Applicant shall be at least 21 years of age.

§ 34.3 *Citizenship.* Applicant shall be a citizen of the United States or of a foreign government which grants reciprocal flight navigator privileges to citizens of the United States on equal terms and conditions with citizens of such foreign government.

§ 34.4 *Education.* Applicant shall be able to read, write, speak, and understand the English language.

§ 34.5 *Physical standards.* Applicant shall meet the physical standards of the second class prescribed in Part 29 of this subchapter.

§ 34.6 *Experience.* (a) Applicant shall:

(1) Have at least 200 hours of satisfactory flight navigation including celestial and radio navigation and dead reckoning: *Provided*, That a pilot who has logged 500 hours of cross-country flight, of which 100 hours shall have been at night, may be credited with not more than 100 hours toward this experience; and

(2) Have satisfactorily determined his position in flight not less than 25 times by night by celestial observations and not less than 25 times by day by celestial observations in conjunction with other aids; or

(b) Applicant shall be a graduate of a flight navigator course approved by the Administrator.

§ 34.7 *Knowledge.* Applicant shall pass a written examination on the following subjects:

(a) Those provisions of the regulations in this subchapter pertinent to the duties of a navigator in the navigation of aircraft;

(b) The fundamentals of flight navigation, including flight planning and cruise control;

(c) Practical meteorology, including the analysis of weather maps, weather reports, and weather forecasts; weather sequence abbreviations, symbols, and nomenclature;

(d) Types of air navigation facilities and procedures in general use;

(e) The calibration and use of instruments used in air navigation;

(f) Navigation by dead reckoning;

(g) Navigation by celestial means;

(h) Navigation by means of radio aids;

(i) Pilotage and map reading;

(j) Interpretation of navigational aid identification signals.

§ 34.8 *Skill.* (a) Applicant shall pass a practical examination in the operation of flight navigational equipment.

(b) Applicant shall accomplish practical tests in aircraft navigation by:

(1) Dead reckoning;

(2) Celestial means; and

(3) Radio aids to navigation.

CERTIFICATION RULES

§ 34.10 *Application.* Application shall be made on a form and in the manner prescribed by the Administrator.

§ 34.11 *Duration.* A flight navigator certificate shall remain in effect unless it is suspended, or revoked, or a general termination date for such certificate is fixed by the Board.

§ 34.12 *Temporary certificates.* The Administrator or his authorized representative may issue a temporary flight navigator certificate for a period of not to exceed 90 days, subject to the terms and conditions specified therein by the Administrator.

§ 34.13 *Reexamination.* Applicants who have failed in any examination may apply for reexamination on the part failed after 30 days from the date of such failure.

§ 34.14 *Certificate.* No individual shall serve in the flight crew as a flight navigator unless he has in his personal possession while so serving a valid flight navigator certificate issued by the Administrator.

[Amdt. 34-1, 13 F. R. 4759]

§ 34.15 *Medical certificate and renewal.* No individual shall exercise the privileges of a flight navigator certificate unless he has in his personal possession while so serving a medical certificate or other evidence satisfactory to the Administrator showing that he has met the physical requirements appropriate to his certificate within the preceding 12 calendar months.

[Amdt. 34-1, 13 F. R. 4759]

§ 34 16 *Certificate display.* A flight navigator shall, upon request, present his airman and medical certificates for examination by any representative of the Civil Aeronautics Board or Administrator or by any State or local law enforcement officer.

[Amdt. 34-1, 13 F. R. 4759]

§ 34.17 *Operation during physical deficiency.* No flight navigator shall exercise the privileges of his airman certificate during any period of known physical deficiency or increase in physical deficiency which would render him unable to meet the physical requirements prescribed for the issuance of his currently effective medical certificate.

[Amdt. 34-1, 13 F. R. 4759]

PART 35—FLIGHT ENGINEER CERTIFICATES

REQUIREMENTS FOR CERTIFICATE

AUTHORITY: §§ 35.1 to 35.32 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 601, 602, 52 Stat. 1007, 1008, 49 U. S. C. 551, 552; Pub. Law 872, 80th Cong.

SOURCE: §§ 35.1 to 35.32 contained in Amendment 35-0, Civil Air Regulations, 12

F. R. 41, except as noted following provision affected.

NOTE: The following explanatory statement was issued as a part of Amendment 35-0:

In accordance with the provisions of Title VI of the Civil Aeronautics Act of 1938 it is unlawful for any person to serve in any capacity as an airman in connection with any civil aircraft used in air commerce without an airman certificate authorizing him to serve in such capacity, or in violation of the terms of any such certificate. A flight engineer falls within the definition of airman as defined in that act.

The purpose of this part is to provide a means for compliance with the airman requirements of Title VI of the act with respect to the use in air commerce of those types of aircraft which require the services of flight engineers by providing the standards by which flight engineers may be certificated as airmen.

REQUIREMENTS FOR CERTIFICATE

§ 35.1 *Issuance.* A flight engineer certificate will be issued to an applicant who meets the requirements of §§ 35.2–35.9.

§ 35.2 *Age.* Applicant shall be at least 21 years of age.

§ 35.3 *Citizenship.* Applicant shall be a citizen of the United States or of a foreign government which grants reciprocal flight engineer privileges to citizens of the United States on equal terms and conditions with citizens of such foreign government.

§ 35.4 *Education.* Applicant shall be able to read, write, speak, and understand the English language.

§ 35.5 *Physical standards.* Applicant shall meet the physical standards of the second class prescribed in Part 29 of this subchapter.

§ 35.6 *Experience.* Each applicant for a flight engineer certificate shall:

(a) Have had at least 3 years of diversified practical experience in the maintenance and repair of aircraft and aircraft engines, of which one year shall have been in the maintenance and repair of multiengine aircraft of a type used in air carrier operations and having engines rated at least at 800 horsepower each; or

(b) Be a graduate of at least a two-year specialized aeronautical training course in the maintenance, repair, and overhaul of aircraft and aircraft engines, of which at least six months shall be in the maintenance and repair of multiengine aircraft of a type used in air carrier operations and having engines rated at least at 800 horsepower each; or

(c) Have had at least 100 hours of flight experience in the duties of a flight engineer; or

(d) Have satisfactorily completed a course of ground and flight instruction in at least the items specified in § 35.7 which the Administrator has found adequate for the training of a flight engineer; or

(e) Have had at least 200 hours of flight time as pilot in command of an aircraft having 4 engines or more.

[Amdt. 35-1, 14 F. R. 2196]

§ 35.7 *Knowledge.* Applicant shall pass a written examination on the following subjects pertaining to aircraft having 4 or more engines and certificated in the transport category or to aircraft having 4 or more engines and incorporating a flight engineer station:

(a) Responsibilities and limitations of a flight engineer as specified in the regulations of this subchapter.

(b) Theory of flight and elementary aerodynamics;

(c) Aircraft performance and aircraft engine operation with respect to limitations;

(d) Mathematical computations of engine operation and fuel consumption, including basic meteorology with respect to engine operations;

(e) Aircraft loading and center of gravity computations;

(f) Basic aircraft maintenance and operating procedures.

[Amdt. 35-1, 13 F. R. 2645]

§ 35.8 *Skill.* Applicant shall pass a practical test in the duties of a flight engineer during flight on an aircraft having 4 or more engines and certificated in the transport category or on an aircraft having 4 or more engines and incorporating a flight engineer station; and shall demonstrate competency with respect to:

(a) Normal duties and procedures relating to aircraft, aircraft engines, propellers, and appliances;

(b) Recognition of the malfunctioning of aircraft, aircraft engines, propellers, and appliances, and the taking of appropriate action thereon;

(c) Emergency duties and procedures relating to aircraft, aircraft engines, propellers, and appliances.

[Amdt. 35-1, 13 F. R. 2645]

§ 35.9 *Limited certificate.* (a) An applicant may be certificated as a flight engineer for an aircraft having less than 4 engines: *Provided*, That (1) the design of the aircraft incorporates a flight engineer station satisfactory to the Administrator, (2) the applicant meets the requirements of §§ 35.1 through 35.6, and (3) the applicant passes written and practical examinations respecting such aircraft on the subjects listed in §§ 35.7 and 35.8.

(b) A certificate issued under the provisions of this section shall contain an appropriate limitation which may be removed at such time as the holder of the certificate passes the written and practical tests prescribed in §§ 35.7 and 35.8.

[Amdt. 35-1, 13 F. R. 2645]

CERTIFICATION RULES

§ 35.10 *Application.* Application shall be made on a form and in the manner prescribed by the Administrator.

§ 35.11 *Duration.* A flight engineer certificate shall remain in effect unless it is suspended, or revoked, or a general termination date for such certificate is fixed by the Board.

§ 35.12 *Temporary certificates.* The Administrator or his authorized representative may issue a temporary flight engineer certificate for a period of not to exceed 90 days, subject to the terms and conditions specified therein by the Administrator.

[Amdt. 35-1, 12 F. R. 1030]

§ 35.13 *Surrender.* Any flight engineer shall, upon request, deliver his certificate to the Administrator, if it has been suspended or revoked.

§ 35.14 *Reexamination.* Applicants who have failed in any examination may apply for reexamination on the part failed after 30 days from the date of such failure.

§ 35.15 *Certificate.* No individual shall serve in the flight crew as a flight engineer unless he has in his personal possession while so serving a valid flight engineer certificate issued by the Administrator.

[Amdt. 35-2, 13 F. R. 4760]

§ 35.16 *Medical certificate and renewal.* No individual shall exercise the privileges of a flight engineer certificate unless he has in his personal possession while so serving a medical certificate or other evidence satisfactory to the Administrator showing that he has met the physical requirements appropriate to his certificate within the preceding 12 calendar months.

[Amdt. 35-2, 13 F. R. 4760]

§ 35.17 *Certificate display.* A flight engineer shall, upon request, present his airman and medical certificates for examination by any representative of the Civil Aeronautics Board or Administrator or by any State or local law enforcement officer.

[Amdt. 35-2, 13 F. R. 4760]

§ 35.18 *Operation during physical deficiency.* No flight engineer shall exercise the privileges of his airman certificate during any period of known physical deficiency or increase in physical deficiency which would render him unable to meet the physical requirements prescribed for the issuance of his currently effective medical certificate.

[Amdt. 35-2, 13 F. R. 4760]

DEFINITIONS

§ 35.30 *Definitions.* (a) As used in this part the words listed below shall be defined as follows:

[Amdt. 35-1, 14 F. R. 2196]

§ 35.31 *Flight time.* Flight time shall mean the total time from the moment the aircraft first moves under its own power for the purpose of flight until the moment it comes to rest at the end of the flight (block to block).

[Amdt. 35-1, 14 F. R. 2196]

§ 35.32 *Pilot in command.* Pilot in command shall mean the pilot responsible for the operation and safety of the aircraft during the time defined as flight time.

[Amdt. 35-1, 14 F. R. 2196]

PART 40—AIR CARRIER OPERATING CERTIFICATION

AUTHORITY: §§ 40.1 to 40.205 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 601, 604, 52 Stat. 1007, 1010; 49 U. S. C. 551, 554.

SOURCE: §§ 40.1 to 40.205 contained in Civil Air Regulations, May 31, 1938, as amended by Regulation 601-A-1, 3 F. R. 2056 and Amendment 129, 6 F. R. 4691, except as noted following sections affected.

NOTE 1: Special Regulations, Serial No. SR-331, 14 F. R. 3199, provides as follows:

Flights of scheduled air carriers while at altitudes in excess of 12,500 feet above sea level east of Longitude 100° W. and 14,500 feet above sea level west of Longitude 100° W. shall comply with the applicable provisions of the Civil Air Regulations except as follows:

(a) Such flights need not comply with the requirements of § 60.45 Right-side traffic, § 61.252 Deviation from route, or any other sections of Parts 40 and 61 of this subchapter concerning civil airways.

(b) Such flights need not comply with the requirements of § 60.43 Air traffic clearance, § 60.21 Adherence to air traffic clearances, § 60.47 Radio communications, and § 61.171 Weather reports, except to the extent which the Administrator may prescribe.

(c) Each first pilot engaged in these operations shall be qualified for the route, if he is qualified for operations over any regular authorized route for the air carrier involved between the regular terminals for such operation.

(d) Each dispatcher who dispatches aircraft on flights authorized by this regulation shall be qualified under § 61.154 of this subchapter for operation over an authorized route for the air carrier involved between the regular terminals of such operations: *Provided*, That when he is qualified only on a portion of such route he may dispatch aircraft only after coordinating the dispatch with dispatchers who are qualified for the other portions of the route between the points to be served.

This regulation supersedes Special Civil Air Regulation Serial No. 323, as amended, and shall terminate December 31, 1949.

NOTE 2: Special Regulations, Serial No. SR-326, 13 F. R. 5208, provides as follows:

An air carrier operating certificate, or amendments thereto, may be issued by the Administrator to an air carrier holding a temporary certificate of public convenience and necessity issued by the Board, authorizing such carrier to engage in scheduled air carrier operations which do no fully meet the certification and operation requirements of Parts 40 and 61 of this subchapter if the Administrator finds that any of such requirements can be omitted or modified without adversely affecting safety. Such omissions or modifications, when approved by the Administrator, shall be listed in the air carrier operating certificate, and the Administrator shall promptly notify the Board of the omissions or modifications approved by him and the reasons therefor.

This regulation supersedes Special Civil Air Regulation Serial No. 396 and shall terminate August 31, 1949.

NOTE 3: Special Regulation SR-325, effective Aug. 27, 1948, 13 F. R. 5147, provides in part as follows:

Any air carrier authorized * * * to engage in scheduled air transportation of cargo may conduct such transportation under the air carrier certification and operation rules prescribed in Part 42 of this chapter.

§ 40.1 *Provision for issuance.* Pursuant to the provisions of the Civil Aeronautics Act of 1938, as amended, empowering the Administrator of Civil Aeronautics to issue air carrier operating certificates and the Board to establish minimum safety standards for the operation of the air carrier to whom any such certificate is issued, the following regulations are prescribed for such certification of scheduled air carriers engaged in interstate air transportation within the continental limits of the United States, as to their competency.

[CAR, May 31, 1938, as amended by Amdt. 75, 5 F. R. 3946, and Amdt. 133, 6 F. R. 5038]

GENERAL MINIMUM REQUIREMENTS

§ 40.5 *Eligibility.* To be eligible for an air carrier operating certificate, an applicant shall meet and comply with the general minimum requirements of §§ 40.6–40.13.

§ 40.6 *Economic strength.* Applicant shall show economic and financial strength sufficient to establish a presumption of ability to operate the air carrier with reasonable safety as related to the service offered, for a period of at least 1 year.

§ 40.7 *Route.* Applicant shall show that the route over which it proposes to operate is, or prior to operation will be, equipped with such navigational facilities (including terminal and intermediate airports, emergency landing fields, and ground aids to air navigation) as are determined by the Administrator to be necessary for safe operation as related to the service offered.

[Amdt. 40-8, 11 F. R. 7033]

§ 40.8 *Definition of route.* A route is that portion of the navigable airspace designated by the Administrator which is to be used by the air carrier in scheduled air transportation.

[Amdt. 40-3, 11 F. R. 5645]

§ 40.9 *Aircraft.* Applicant shall show certificated aircraft of a type and number found by the Administrator to be adequate for safe operation as related to the service offered, the route traversed, and the operating and maintenance procedures and techniques proposed. (See also §§ 40.21–40.102.)

[Amdt. 40-7, 11 F. R. 5996, as amended by Amdt. 40-3, 14 F. R. 2196]

§ 40.10 *Airmen.* Applicant shall show certificated airmen (including both flight and ground personnel) of kind, grade, and number deemed by the Administrator to be necessary for safe operation as related to the service offered, the route traversed, the aircraft used, and the operating and maintenance procedures, and techniques proposed.

§ 40.11 *Operations manual.* Applicant shall show an operations manual, prepared for the use of its airmen, which fully details the operating and communications methods, procedures, and techniques proposed for its air carrier operations.

§ 40.12 *Maintenance manual.* Applicant shall show a maintenance manual or suitable equivalent prepared for the use of its airmen and other maintenance personnel which adequately defines the maintenance methods, procedures, and techniques proposed for its air carrier operation.

§ 40.13 *Schedules.* Applicant shall show proposed schedules set up with due regard for sufficient time for the adequate servicing with fuel and oil at intermediate stops, and to prevailing winds, and on the basis of a cruising speed of the aircraft at not to exceed the specified cruising power output of the engines as operated in the aircraft.

PASSENGER MINIMUM REQUIREMENTS

§ 40.21 *Qualifications.* (a) Aircraft certificated as a basic type after June 30, 1942, shall be certificated in accordance with Part 4b of this subchapter, or the transport category requirements of Part 4a of this subchapter, and shall meet the requirements of § 61.213 of this subchapter over each route to be flown.

(b) Aircraft certificated as a basic type prior to June 30, 1942, shall either:

(1) Retain their present airworthiness certification status and shall be operated in accordance with such operating limitations as the Administrator finds will provide a safe relation between the performance of the aircraft and the dimensions of airports and terrain; or

(2) Qualify by showing compliance with either the performance requirements contained in §§ 4a.737-T through 4a.750-T or the requirements contained in Part 4b of this subchapter, and when so qualified shall meet the requirements of § 61.213 of this subchapter over each route to be flown: *Provided*, That should any type be so qualified all aircraft of any one operator of the same or related types shall be similarly qualified and operated.

(c) Aircraft used after December 31, 1953, shall comply with all of the requirements of Part 4b of this subchapter or the transport category requirements of Part 4a of this subchapter and shall meet the requirements of § 61.213 of this subchapter over each route to be flown.

[Amdt. 40-2, 13 F. R. 746, as amended by Amdt. 40-6, 14 F. R. 2196]

ROUTE REQUIREMENTS: VISUAL-CONTACT DAY OPERATION

§ 40.26 *Airway.* Applicant shall show that the regular route over which the proposed operations will be conducted is, or prior to authorization will be, within the limits of a civil airway, or is otherwise deemed satisfactory by the Administrator for the operation proposed. (If applicant's proposed route does not lie within the limits of a civil airway, a petition requesting that a civil airway be designated to embrace such route may be made simultaneously with the air carrier operating certificate application.)

§ 40.27 *Airports.* Applicant shall show that the airports to be used as terminals and scheduled intermediate stops are deemed adequate by the Administrator for safe air carrier operation of the type proposed.

[Amdt. 51, 5 F. R. 1838]

§ 40.28 *Public protection.* Applicant shall show that reasonable and adequate facilities and safety devices (including protection from revolving aircraft propellers) are provided for the protection of the public at each terminal and scheduled intermediate stop.

§ 40.29 *Intermediate fields.* Applicant shall show intermediate fields or airports available for safe landings with the load authorized for the route, or part thereof, and located so that the aircraft, when flying along the proposed route, shall at no time be at a distance greater than 100 miles from an intermediate field or airport: *Provided*, That the Administrator may permit or require intermediate fields at greater or less distances if suitable or necessary to provide adequate safety along the proposed route.

[CAR, May 31, 1938, as amended by Amdt. 40-1, 8 F. R. 1334]

§ 40.30 *Refueling facilities.* Applicant shall show that adequate refueling facilities, including equipment to test gasoline storage tanks for the presence of water and to remove any water or condensation found therein, are provided at each terminal, scheduled intermediate stop, and intermediate field where refueling is contemplated.

§ 40.31 *Radio facilities.* Applicant shall show a two-way ground-to-aircraft radiotelephone communication system at such terminals and at such points as may be deemed necessary by the Administrator to insure satisfactory communications over the entire route under normal operating conditions. Such system shall be independent of radio facilities provided by Federal or other governmental agencies.

§ 40.32 *Weather reporting.* Applicant shall show weather reporting services at the proposed terminals and enroute, adequate to insure sufficient weather reports prepared from observations made and released by the United States Weather Bureau or by a source approved by it.

ROUTE REQUIREMENTS: VISUAL-CONTACT NIGHT OPERATION

§ 40.36 *Airway.* Applicant shall meet the requirements of § 40.26 and, in addition, shall show that the proposed route is equipped with such airway beacons and obstruction lights as are deemed by the Administrator to be adequate for safe air carrier operation at night.

§ 40.37 *Airports.* Applicant shall meet the requirements of § 40.27 and, in addition, shall show that the airport to be used at each proposed terminal and scheduled intermediate stop is equipped with such lighting facilities as are deemed by the Administrator to be adequate for safe air carrier operation at night.

§ 40.38 *Public protection.* Same as in § 40.28.

§ 40.39 *Intermediate fields.* Applicant shall meet the requirements of § 40.29 and, in addition, shall show that such intermediate fields are equipped with lighting facilities as required by § 40.37.

§ 40.40 *Refueling facilities.* Same as in § 40.30.

§ 40.41 *Radio facilities.* Same as in § 40.31.

§ 40.42 *Weather reporting.* Same as in § 40.32.

ROUTE REQUIREMENTS: INSTRUMENT OR OVER-THE-TOP OPERATION

§ 40.46 *Airway.* (a) Applicant shall meet the requirements of § 40.26 for day operation, or of § 40.36 for night operation. In addition, for either day or night operation, applicant shall show that the proposed route is equipped with radio ranges (or equivalent facilities) adequate for safe air carrier operation, projecting courses over the proposed route. The applicant may show, in lieu of courses projected over the proposed route by such radio ranges or equivalent facilities, (1) that instrument navigation may be safely conducted over the proposed route by the use of radio direction finding equipment installed in the aircraft, and (2) that a practical alternate route, equipped with radio range stations (or equivalent facilities) projecting courses over such alternate route, exists between the terminals of the proposed route.

(b) Applicant shall also show such other radio navigational aids (including radio markers) as are necessary for safe air carrier operation.

[Amdt. 102, 6 F. R. 1159]

§ 40.47 *Airports.* For day operation applicant shall show that the airport to be used at each proposed route terminal, scheduled intermediate stop, and alternate terminal is deemed adequate by the Administrator for the service offered. For night operation applicant shall meet the foregoing requirements and, in addition, shall show that the proposed terminal, scheduled intermediate stop, and alternate airports are provided with such lighting facilities as are deemed by the Administrator to be adequate for safe air carrier operation at night.

§ 40.48 *Public protection.* Same as in § 40.28.

§ 40.49 *Intermediate fields.* Same as in § 40.29 for day operation, and as in § 40.39 for night operation.

§ 40.50 *Refueling facilities.* Same as in § 40.30.

§ 40.51 *Radio facilities.* Same as in § 40.31.

§ 40.52 *Weather reporting.* Same as in § 40.32.

AIRCRAFT REQUIREMENTS: VISUAL-CONTACT DAY OPERATION

§ 40.56 *If single-engine operation over land.* Applicant shall show land aircraft of type and number necessary for safe operation, or applicant may show a similar number of water aircraft if the route to be flown over is such that the aircraft can, at all times, reach open water deemed suitable by the Administrator for a safe landing in the event of complete power failure. Single-engine aircraft may be operated over routes deemed by the Administrator to have suitable landing terrain.

[CAR, May 31, 1938, as amended by Amdt. 40-3, 14 F. R. 2196]

§ 40.57 *If single-engine operation over water.* Applicant shall show water aircraft of type and number necessary for safe operation, or applicant may show a similar number of land aircraft if the route to be flown over is such that the aircraft can, at all times, reach land deemed suitable by the Administrator for a safe landing in the event of complete power failure.

[CAR, May 31, 1938, as amended by Amdt. 40-3, 14 F. R. 2196]

§ 40.58 *If multiengine operation over land*—(a) *Qualification.* Applicant shall show aircraft of a type and number necessary for safe operation. Applicant shall also show:

(1) That such aircraft (other than those specifically listed as in scheduled air carrier service by the applicant prior to January 1, 1935) to be used on the proposed route or part thereof are capable, with any one engine inoperative, of maintaining level flight with authorized load for the route or part thereof at an altitude of at least 1,000 feet above the highest obstruction to flight on the valley level of the route or part thereof on which the aircraft will be operated; or

(2) Operating procedures which, in the opinion of the Administrator, will assure that such aircraft will be capable of effecting a safe landing at an airport or other suitable area in the event of the failure of any one engine at any point on the route on which such aircraft will be operated.

(b) *Engine rotation.* On and after July 1, 1941, applicant shall show that any aircraft to be used in air transportation which have engines with maximum power ratings of 480 horsepower or more are so equipped that engine rotation may be promptly stopped during flight; and, on and after January 1, 1943, the same showing shall be made with respect to all other aircraft to be used in air transportation.

[Amdt. 29, 4 F. R. 4186, as amended by Amdt. 79, 5 F. R. 4261, Amdt. 40-10, 7 F. R. 2144, and Amdt. 40-3, 14 F. R. 2196]

§ 40.59 *If multiengine operation over water*—(a) *Qualification.* Applicant shall show aircraft of type and number necessary for safe operation. Applicant shall also show that such aircraft, which are to be used on the proposed route or part thereof are capable, with any one engine inoperative, of maintaining level flight with authorized load at an altitude of at least 1,000 feet above the water. No multiengine land aircraft shall be operated, over water, beyond gliding distance from shore without the aid of power, unless such aircraft is equipped with a retractable landing gear, with one or more suitable emergency exits located in the upper half of the fuselage, with life preservers or other adequate flotation devices readily available for each person on board, with a Very pistol and cartridges or equivalent signal equipment deemed suitable by the Administrator, and with radio equipment as required by § 40.79. The requirements of flotation devices and signal equipment do not apply where such operations consist only of landings, take-offs, or flights of short duration over water and the Administrator finds in each case that such equipment is unnecessary.

(b) *Engine rotation.* Same as in § 40.58 (b).

[CAR, May 31, 1938, as amended by Amdt. 79, 5 F. R. 4261, Amdt. 40-10, 7 F. R. 2144, and Amdt. 40-3, 14 F. R. 2196]

§ 40.60 *Number of aircraft.* Applicant shall show aircraft, certificated as provided in §§ 4b.547-4b.552, of a number sufficient to permit the maintenance of all schedules proposed, as provided for in § 40.13.

§ 40.61 *Radio equipment.* Applicant shall show that each aircraft is equipped with a type certificated two-way radiotelephone having sufficient power to permit communication, under normal operating conditions, with at least one ground station used or to be used by the applicant on the regular or alternate route, and capable of communication with other aircraft of the applicant in flight. In addition, each aircraft shall be provided with at least one type certificated radio receiving system capable of receiving radio range signals and weather broadcasts. Such receiving system shall include a type certificated audio filter system with suitable switching arrangements to be used in connection with the reception of simultaneous radio range and voice broadcasts: *Provided,* That such audio filter system will not be required if the airway or route traversed is not equipped with simultaneous type radio range stations.

[Amdt. 85, 5 F. R. 5145]

§ 40.62 *Hangar facilities.* Applicant shall show hangar or other facilities adequate for the proper maintenance of the aircraft, engines, equipment, and parts.

§ 40.63 *Shop facilities.* Applicant shall show shop facilities (including facilities for servicing, repair, and overhaul) adequate for the proper maintenance of all aircraft, engines, and equipment used.

§ 40.64 *Inspection and overhaul organization and procedures.* Applicant shall show inspection and overhaul organization, procedures, and techniques adequate for the proper maintenance of all aircraft, engines, and equipment used.

AIRCRAFT REQUIREMENTS: VISUAL-CONTACT NIGHT OPERATION

NOTE: Single-engine aircraft may not be used in night operation with passengers.

§ 40.66 *If operation over land.* Applicant shall show multiengine land aircraft, which meet the flight performance requirements of § 40.58 and of a number necessary for safe operation as provided for in § 40.60.

§ 40.67 *If operation over water.* Applicant shall show multiengine land aircraft, which meet the flight performance and equipment requirements of § 40.59, and of a number necessary for safe operation as provided for in § 40.60.

§ 40.68 *Number of aircraft.* Same as in § 40.60.

§ 40.69 *Radio equipment.* Same as in § 40.61.

§ 40.70 *Hangar facilities.* Same as in § 40.62.

§ 40.71 *Shop facilities.* Same as in § 40.63.

§ 40.72 *Inspection and overhaul organization and procedures.* Same as in § 40.64.

AIRCRAFT REQUIREMENTS: INSTRUMENT OR OVER-THE-TOP OPERATION

NOTE: Single-engine aircraft may not be used in an instrument or over-the-top operation with passengers.

§ 40.76 *If operation over land*—(a) *Qualification.* Applicant shall show multiengine aircraft of type and number necessary for safe operation. Applicant shall also show:

(1) That such aircraft (other than those specifically listed as in scheduled air carrier service by the applicant prior to January 1, 1935) to be used on the proposed route, or part thereof, are capable, with any one engine inoperative, of maintaining level flight, with authorized load for the route or part thereof, at an altitude equivalent to 1,000 feet above the highest part of the terrain on the proposed instrument course of the route, or part thereof; or

(2) Operating procedures which, in the opinion of the Administrator, will assure that such aircraft will be capable of effecting a safe landing at an airport or other suitable area in the event of the failure of any one engine at any point on the route on which such aircraft will be operated.

(b) *Engine rotation.* Same as in § 40.58 (b).

[Amdt. 29, 4 F. R. 4186, as amended by Amdt. 79, 5 F. R. 4261, Amdt. 40-10, 7 F. R. 2144, and Amdt. 40-3, 14 F. R. 2196]

§ 40.77 *If operation over water.* Same as in § 40.67.

§ 40.78 *Number of aircraft.* Same as in § 40.60.

§ 40.79 *Radio equipment.* Same as in § 40.61 and, in addition, applicant shall show that there is installed in each aircraft to be used in instrument or over-the-top operation (during day or night) over the proposed route, or part thereof, one additional separate type certified radio receiving system capable of receiving radio range signals and weather broadcasts. Such receiver system shall normally operate from the main source of electrical supply of the aircraft but, in event of failure of the normal power source, shall be capable of being switched to operate from an independent power source. This system shall include an independent power source capable of operating such receiver continuously for a period of at least 4 hours. It is also required that such receiver operate from an independent antenna or from either of two antennas. Two sets of type certificated headphones and two type certificated microphones shall be carried in the aircraft at all times.

(a) *Radio direction finder.* Applicant shall show that there is installed in each aircraft a type certificated radio direction finder, covering at least the frequency range of 200 to 400 kilocycles. The design of the radio direction finder shall be such as to permit its regular operation in the taking of line bearings on any station to which the direction finder may be tuned without altering the course of the aircraft. The radio direction finder shall also be provided with means to eliminate, insofar as possible consistent with the advancement of the art, that type of interference commonly known as rain, snow, sleet, or dust static. The radio direction finder shall provide means for audible reception of radio range and weather broadcast messages. It may be installed in lieu of the emergency receiver required in this section provided that an independent power source equal to that described therein for such receiver is employed on either the radio range receiver required therein or on this radio direction finder.

(b) *Radio anti-static antenna.* Applicant shall show that there is installed in each aircraft a type certificated radio antenna system, which has for its purpose the collection of radio range signals, weather broadcast and emergency messages transmitted within the frequency range of 200 to 400 kilocycles. The design of this antenna system shall be such as to eliminate insofar as possible, consistent with the advancement of the art, that type of interference commonly known as rain, snow, sleet, or dust static. This antenna system shall be designed to operate efficiently when used in conjunction with a receiver installed aboard such aircraft which has for its primary purpose the reception of radio range signals, weather broadcast and emergency messages.

(c) *Marker beacon receiver.* Applicant shall show that there is installed in each aircraft a type certificated ultra-high frequency receiving system operating on the frequency of 75 megacycles. The system shall provide means for the visual and aural indications of signals transmitted by ultra-high frequency positive-cone-of-silence and fan type marker stations. The design of the system shall preclude, insofar as possible, erroneous patterns of the transmitted signal caused by the receiving system. Such receiving system will not be required if the airway or route traversed is not equipped with ultra-high frequency positive-cone-of-silence or fan type marker stations.

[CAR, May 31, 1938, as amended by Admt 85, 5 F. R. 5145]

§ 40.80 *Hangar facilities.* Same as in § 40.62.

§ 40.81 *Shop facilities.* Same as in § 40.63.

§ 40.82 *Inspection and overhaul organization and procedures.* Same as in § 40.64.

AIRMEN REQUIREMENTS: VISUAL-CONTACT DAY OPERATION

§ 40.86 *Number.* Applicant shall show airmen of a number sufficient to permit the maintaining of all schedules proposed, under safe operating conditions.

§ 40.87 *First pilots.* Applicant shall show that prior to the issuance of the air carrier operating certificate all persons employed to serve as first pilots for the air carrier meet the following minimum requirements for qualification as to aircraft and route competency.

(a) Each first pilot shall be possessed of a valid air-line transport pilot competency rating with specifications or ratings indicating competency to pilot aircraft of each type to be used by him in scheduled operation.

(b) *Requirements for pilot route qualifications.* The air carrier shall be responsible for qualifying each first pilot for the route over which he is to fly aircraft in scheduled air transportation as first pilot. Such qualification shall include a thorough knowledge of all of the instrument approach procedures, the terrain, any obstructions or congested areas, and the physical layout of the airport and approaches at each regular, provisional, refueling, and alternate airport approved for the route. It shall also include the navigational facilities, communications procedures, minimum safe flight levels, position reporting points, holding procedures, and all other traffic control procedures for the route. In complying with the foregoing requirements the air carrier shall establish a detailed qualifying procedure, including flight over the route, which shall be performed by the pilot qualifying for the route. Such procedure shall be submitted for the approval of the Administrator and when approved by him shall be made a part of the air carrier operating certificate. A pilot may be listed in the air carrier operating certificate as first pilot for the route when the air carrier has certified to the Administrator that the pilot has performed the qualifying procedures and is qualified for the route, and this certification is endorsed by the pilot.

(c) Each first pilot shall be familiar with the aircraft, and shall demonstrate to an authorized air carrier inspector of the Administrator, or to a check pilot of the air carrier duly authorized by the Administrator, satisfactory capability to maneuver such aircraft with the maximum authorized load for the route or part thereof; and, in addition, if the aircraft is multiengined, he shall demonstrate his ability to maneuver such aircraft with said load with any one engine fully throttled either:

(1) At an altitude equivalent to 500 feet above the highest part of the terrain on the proposed route or part thereof to be flown by the pilot in air carrier service, or

(2) At the one-engine-inoperative service ceiling.

[CAR, May 31, 1938, as amended by Amdt. 51, 5 F. R. 1838, Amdt. 40-2, 8 F. R. 3566, Amdt. 40-4, 11 F. R. 5645, and Amdt. 40-3, 14 F. R. 2196]

§ 40.88 *Second pilots.* Applicant shall show that each person employed to serve as a second pilot for the air carrier is possessed of at least a valid commercial pilot competency rating and before serving as second pilot in any aircraft in scheduled air transportation service shall have demonstrated, to an air carrier inspector representing the Administrator or to a check pilot of the air carrier duly authorized by the Administrator, his ability to take-off and land such aircraft in which he is to serve by making at least three satisfactory take-offs and landings in each type of such aircraft. On and after July 1, 1938, each applicant for or holder of an air carrier operating certificate will be required to show that each such person is possessed of a valid instrument rating, unless possessed of a valid airline transport pilot competency rating.

[CAR, May 31, 1938, as amended by Amdt. 40-3, 14 F. R. 2196]

§ 40.89 *Aircraft dispatchers.* Applicant shall show that each person assuming aircraft dispatcher duties for the air carrier is familiar with the route or part thereof over which he will dispatch aircraft, the weather characteristics and phenomena peculiar to such route, the nature and peculiarities of the terrain and of obstructions to flight, the air navigation facilities available on the ground and in the aircraft, the contents of the operations manual of the proposed air carrier and the aircraft limitations specified in the certificates of the aircraft proposed for use. On and after July 1, 1938, each applicant for or holder of an air carrier operating certificate will be required to show that each such person is possessed of a valid and appropriate aircraft dispatcher competency rating.

AIRMEN REQUIREMENTS: VISUAL-CONTACT NIGHT OPERATION

§ 40.91 *Number.* Same as in § 40.86.

§ 40.92 *First pilots.* Same as in § 40.87, except that at least one one-way trip of those trips required by § 40.87 (b) shall have been made during the period between 1 hour after sunset and 1 hour before sunrise.

[Amdt. 40-2, 8 F. R. 3566]

§ 40.93 *Second pilots.* Same as in § 40.88.

§ 40.94 *Aircraft dispatchers.* Same as in § 40.89.

AIRMEN REQUIREMENTS: INSTRUMENT OR OVER-THE-TOP OPERATION

§ 40.96 *Number.* Same as in § 40.86.

§ 40.97 *First pilots.* Same as in § 40.87 and, in addition, applicant shall show that each first pilot, for whom instrument authorization is sought, has demonstrated to an air carrier inspector representing the Administrator, or to a check pilot of the air carrier duly authorized by the Administrator, satisfactory capability with respect to the following:

(a) Familiarity with the aircraft, including demonstration of ability to maneuver such aircraft with the maximum authorized load for the route or part thereof, with any one engine fully throttled, either:

(1) At an altitude equivalent to 1,000 feet above the highest part of the terrain on the proposed instrument course of the route, or part thereof, to be flown by the pilot in air carrier service, or

(2) At the one-engine-inoperative service ceiling.

(b) Familiarity with the route and with instruments, including demonstration of ability, under actual or simulated conditions, to fly such route solely by instruments.

(c) Familiarity with procedures, including demonstration of ability to accomplish a let-down-through by instruments, according to the procedure specified in the appropriate competency letter, at one station at lea ', on the route, in each type of aircraft to be used by the pilot in air carrier operation. Such demonstrations as to the other stations as deemed necessary by the Administrator may be made to an air carrier inspector representing the Administrator, or to a check pilot of the air carrier duly authorized by the Administrator, under simulated conditions or by equivalent means approved by the Administrator.

[CAR, May 31, 1938, as amended by Amdt. 51, 5 F. R. 1838, and Amdt. 40-3, 14 F. R. 2196]

§ 40.98 *Second pilots.* Are required for all instrument operations and shall meet the minimum requirements of § 40.88.

§ 40.99 *Aircraft dispatchers.* Same as in § 40.89.

MISCELLANEOUS REQUIREMENTS

§ 40.101 *Weather minimums.* Authorization of ceiling and visibility minimums for purposes of flight clearance and for transition from instrument to visual-contact flights and vice versa will be made by the Administrator and will be based upon the following considerations affecting the clearance and completion of the flight:

(a) The terrain conditions affecting the flight area necessary for the working out of an approach and let-down-through procedure, or for a climb-up-through procedure; and

(b) The skill and experience of dispatcher personnel; and

(c) The skill and experience of pilot personnel; and

(d) The type and maneuverability of the aircraft; and

(e) The obstructions to flight, considered both vertically and horizontally, in the vicinity of the landing area; and

(f) The quality and quantity of meteorological service and of other ground aids to flight available.

§ 40.102 *Air carrier operating skill.* Applicant shall demonstrate to the satisfaction of the Administrator ability to conduct a safe operation over the entire route to be flown in air transportation. Such demonstration shall be by means of actual flights over each proposed route employing such of the proposed aircraft, airmen, and operating and maintenance procedures and techniques as the Administrator may deem necessary, unless the Administrator after investigation expressly finds (a) that the proposed route modification is minor and (b) that an actual flight is not essential to safety.

[Amdt. 51, 5 F. R. 1838, as amended by Amdt. 40-1, 12 F. R. 3933]

§ 40.102-1 *Route proving flights (CAA rules which apply to § 40.102)*—(a) *Introduction.* The Administrator has the responsibility of determining when route proving flights are necessary. When an air carrier believes that actual route proving flights are not required by the regulations in this subchapter, its officials must submit to the Civil Aeronautics Administration office handling the air carrier's operating certificate, a written request for elimination of such flights. The Administration will undertake an investigation, during which consideration will be given to the nature of the operation to be conducted, and the personnel, equipment, and facilities involved. After investigation, the air carrier will be advised by the Administration that the proposed route modification is minor, and actual route proving flights are not essential to safety, or that actual route proving flights will be required. (For example, a scheduled air carrier may have been granted a minor extension to an existing route, and the extension may be over an airway that is adequately implemented with conventional aids to air navigation. In many such instances, it might be obvious that the proposed operations could be conducted over such a route in accordance with existing safety standards, and in such cases the proving flights would serve no useful purpose.)

(b) *Purpose.* The purpose of route proving flights is to determine the air carrier's ability to conduct the proposed operation in compliance with applicable provisions of the regulations in this subchapter and in accordance with the minimum safety requirements of the Civil Aeronautics Administration. Such determination is predicated upon the adequacy of the facilities provided by, or available to, the air carrier, including, but not limited to, aircraft, airports, lighting facilities, maintenance facilities, communication and navigation facilities, fueling facilities, and ground and aircraft radio facilities, and upon the competency of the pilot, dispatcher, and other airmen or personnel.

(c) *Application.* At least 15 days prior to the scheduling of route proving flights, officials of the air carrier shall submit to the Civil Aeronautics Administration office handling its operations specifications, a written request for the assignment of Civil Aeronautics Administration personnel to observe the flights. This request must be accompanied by an original application and copies of pertinent proposed amendments to the operations specifications, and must include sufficient data pertaining to the route to satisfy the Administrator that the air carrier is prepared for the route proving flights. This will allow sufficient time for making any necessary additions or corrections, thus preventing delays or misunderstandings.

(d) *Conduct.* After the air carrier has made all the necessary preparations to conduct the route proving flights, duly designated representatives of the Civil Aeronautics Administration will be assigned to observe them. All route proving flights shall be undertaken exactly as the operator intends to operate in scheduled air transportation when carrying passengers, property, or mail, or any combination thereof. However, passengers who are not essential to conducting the proving flights must not be carried during such flights. Air carrier personnel assigned to conduct the route proving flights shall be regular crew members who, it is anticipated, will be assigned to the route.

(e) *Duration.* Route proving flights shall continue until the air carrier has demonstrated to the satisfaction of the Administrator that it is competent to conduct a safe operation over the entire route to be flown in air transportation.

(f) *Conclusion.* On completion of the route proving flights, a reasonable period of time will be required in order that the information gained during the flights can be compiled by the field office and submitted, with recommendations regarding approval, to appropriate supervisory personnel of the Civil Aeronautics Administration.

[Supp. 1, 13 F. R. 3459. Correction noted at 14 F. R. 37]

GOODS MINIMUM REQUIREMENTS

§ 40.106 *Eligibility.* To be eligible for an air carrier operating certificate for the carriage of goods (including mail) in interstate air transportation within the continental limits of the United States, an applicant, in addition to meeting the minimum requirements provided for in §§ 40.6–40.13, shall meet and comply with the minimum requirements prescribed in §§ 40.111–40.187 for the particular kind of operation proposed.

[CAR, May 31, 1938, as amended by Amdt. 133, 6 F. R. 5038]

ROUTE REQUIREMENTS: VISUAL-CONTACT DAY OPERATION

§ 40.111 *Airway.* Same as in § 40.26.

§ 40.112 *Airports.* Same as in § 40.27.

§ 40.113 *Public protection.* Same as in § 40.28.

§ 40.114 *Intermediate fields.* Same as in § 40.29.

§ 40.115 *Refueling facilities.* Same as in § 40.30.

§ 40.116 *Radio facilities.* Applicant shall show an adequate two-way ground-to-aircraft communication system which, under normal operating conditions, shall be capable of maintaining communication with all aircraft of the applicant in flight over the proposed route.

[Amdt. 89, 6 F. R. 251, as amended by Amdt. 40–5, 11 F. R. 5646]

§ 40.117 *Weather reporting.* Same as in § 40.32.

ROUTE REQUIREMENTS: VISUAL-CONTACT NIGHT OPERATION

§ 40.121 *Airway.* Applicant shall meet the requirements of § 40.26 and shall show that the proposed route is equipped with such obstruction lights as are necessary for safe air carrier operation at night. In addition, applicant shall show that the proposed route is equipped with such airway beacon lights and radio ranges (or equivalent facilities) as are necessary for safe air carrier operation.

[Amdt. 102, 6 F. R. 1159]

§ 40.122 *Airports.* Same as in § 40.37.

§ 40.123 *Public protection.* Same as in § 40.28.

§ 40.124 *Intermediate fields.* Same as in § 40.39.

§ 40.125 *Refueling facilities.* Same as in § 40.30.

§ 40.126 *Radio facilities.* Same as in § 40.116.

[Amdt. 89, 6 F. R. 251]

§ 40.127 *Weather reporting.* Same as in § 40.32.

ROUTE REQUIREMENTS: INSTRUMENT OR OVER-THE-TOP OPERATION

§ 40.131 *Airway.* Same as § 40.46.

[Amdt. 102, 6 F. R. 1159]

§ 40.132 *Airports.* Same as in § 40.47.

§ 40.133 *Public protection.* Same as in § 40.28.

§ 40.134 *Intermediate fields.* Same as in § 40.29 for day operation, and as in § 40.39 for night operation.

§ 40.135 *Refueling facilities.* Same as in § 40.30.

§ 40.136 *Radio facilities.* Same as in § 40.31.

§ 40.137 *Weather reporting.* Same as in § 40.32.

AIRCRAFT REQUIREMENTS: VISUAL-CONTACT DAY OPERATION

§ 40.141 *If single-engine operation over land.* Same as in § 40.56.

§ 40.142 *If single-engine operation over water.* Same as in § 40.57.

§ 40.143 *If multiengine operation over land*—(a) *Qualification.* Applicant shall show aircraft of type and number necessary for safe operation. Applicant shall also show:

(1) That such aircraft to be used on the proposed route or part thereof are capable, with any one engine inoperative, of maintaining level flight with the authorized load for the route or part thereof at an altitude of at least 1,000 feet above the airport at each terminal and scheduled intermediate stop on the route or part thereof on which the aircraft will be operated; or

(2) Operating procedures which, in the opinion of the Administrator, will assure that such aircraft will be capable of effecting a safe landing at an airport or other suitable area in the event of the failure of any one engine at any point on the route on which such aircraft will be operated.

(b) *Engine rotation.* Same as in § 40.58 (b).

[Amdt. 29, 4 F. R. 4186, as amended by Amdt. 79, 5 F. R. 4261, Amdt. 40–10, 7 F. R. 2144, and Amdt. 40–3, 14 F. R. 2196]

§ 40.144 *If multiengine operation over water.* Same as in § 40.59.

§ 40.145 *Number of aircraft.* Applicant shall show certificated aircraft of a number sufficient to permit the maintenance of all schedules proposed, as provided for in § 40.13.

[Amdt. 40–7, 11 F. R. 5996]

§ 40.146 *Radio equipment.* Applicant shall show that each aircraft is equipped with a type certificated two-way radio telephone system having sufficient power to permit communication under normal operating conditions with at least one ground station used or to be used by the applicant on the route. Such system shall be capable of:

(a) Communication with other aircraft of the applicant in flight, and

(b) Satisfactorily receiving radio range signals and weather broadcasts. Such system shall also include a type certificated audio filter system with suitable switching arrangement to be used in connection with the reception of simultaneous range and voice broadcast if the airway or route to be traversed is equipped with simultaneous type radio range stations.

[Amdt. 89, 6 F. R. 251; as amended by Amdt. 40–5, 11 F. R. 5646]

§ 40.147 *Hangar facilities.* Same as in § 40.62.

§ 40.148 *Shop facilities.* Same as in § 40.63.

§ 40.149 *Inspection and overhaul organization and procedures.* Same as in § 40.64.

AIRCRAFT REQUIREMENTS: VISUAL-CONTACT NIGHT OPERATION

§ 40.151 *If single-engine operation over land.* Applicant shall show aircraft of type and number necessary for safe operation, and in addition thereto, that the routes over which the proposed operation is to be conducted are deemed by the Administrator to have suitable landing terrain.

[CAR, May 31, 1938, as amended by Amdt. 40–3, 14 F. R. 2196]

§ 40.152 *If single-engine operation over water.* Applicant shall show aircraft of type and number necessary for safe operation. Applicant shall also show that the route to be flown over is such that the aircraft can, at all times, reach land deemed suitable by the Administrator for a safe landing in the event of complete power failure.

[CAR, May 31, 1938, as amended by Amdt. 40-3, 14 F. R. 2196]

§ 40.153 *If multiengine operation over land.* Same as in § 40.143.

§ 40.154 *If multiengine operation over water.* Same as in § 40.59.

§ 40.155 *Number of aircraft.* Same as in § 40.145.

§ 40.156 *Radio equipment.* Same as in § 40.146.

[Amdt. 89, 6 F. R. 251]

§ 40.157 *Hangar facilities.* Same as in § 40.62.

§ 40.158 *Shop facilities.* Same as in § 40.63.

§ 40.159 *Inspection and overhaul organization and procedures.* Same as in § 40.64.

AIRCRAFT REQUIREMENTS: INSTRUMENT OR OVER-THE-TOP OPERATION

§ 40.161 *If single-engine operation over land.* Same as in § 40.151.

§ 40.162 *If single-engine operation over water.* Same as in § 40.152.

§ 40.163 *If multiengine operation over land.* Same as in § 40.143.

§ 40.164 *If multiengine operation over water.* Same as in § 40.59.

§ 40.165 *Number of aircraft.* Same as in § 40.145.

§ 40.166 *Radio equipment.* Same as in § 40.79.

§ 40.167 *Hangar facilities.* Same as in § 40.62.

§ 40.168 *Shop facilities.* Same as in § 40.63.

§ 40.169 *Inspection and overhaul organization and procedures.* Same as in § 40.64.

AIRMEN REQUIREMENTS: VISUAL-CONTACT DAY OPERATION

§ 40.171 *Number.* Same as in § 40.86.

§ 40.172 *First pilots.* Applicant shall show prior to the issuance of the air carrier certificate that all persons employed to serve as first pilots for the air carrier meet the following minimum requirements for qualification as to aircraft and route competency:

(a) Each first pilot shall be possessed of at least a valid commercial pilot competency rating with specifications or ratings indicating competency to pilot aircraft of each type to be used by him in scheduled operation. Each first pilot shall also be possessed of a valid instrument rating, unless possessed of a valid air-line transport pilot competency rating.

(b) Same as § 40.87 (b).
(c) Same as § 40.87 (c).

[CAR, May 31, 1938, as amended by Amdt. 51, 5 F. R. 1838, Amdt. 40-6, 11 F. R. 5646, and Amdt. 40-3, 14 F. R. 2196]

§ 40.173 *Second pilots.* Applicant shall show that each person employed to serve as a second pilot for the air carrier is possessed of at least a valid commercial pilot competency rating and before serving as second pilot in any aircraft in scheduled air transportation service shall have demonstrated, to an air carrier inspector representing the Administrator or to a check pilot of the air carrier duly authorized by the Administrator, his ability to take-off and land such aircraft in which he is to serve by making at least three satisfactory take-offs and landings in each type of such aircraft.

[CAR, May 31, 1938, as amended by Amdt. 40-3, 14 F. R. 2196]

§ 40.174 *Aircraft dispatchers.* Same as in § 40.89.

AIRMEN REQUIREMENTS: VISUAL-CONTACT NIGHT OPERATION

§ 40.176 *Number.* Same as in § 40.86.

§ 40.177 *First pilots.* Same as in § 40.172, except that each first pilot shall have logged at least 1,200 hours of certified flight time as pilot in command, and the trip required by § 40.172 (b) shall have been made between the hours of sunset and sunrise.

[CAR, May 31, 1938, as amended by Amdt. 40-3, 14 F. R. 2196]

§ 40.178 *Second pilots.* Same as in § 40.173 and, in addition, 6 months after the effective date of the regulations in this part (May 31, 1938), each applicant for or holder of an air carrier operating certificate will be required to show that each such person is possessed of a valid instrument rating, unless possessed of a valid air-line transport pilot competency rating.

§ 40.179 *Aircraft dispatchers.* Same as in § 40.89.

AIRMEN REQUIREMENTS: INSTRUMENT OR OVER-THE-TOP OPERATION

§ 40.181 *Number.* Same as in § 40.86.

§ 40.182 *First pilots.* Same as in § 40.172, except that each first pilot shall have logged at least 1,200 hours of certified flight time as pilot in command, and, in addition, applicant shall show that each first pilot, for whom instrument authorization is sought, has demonstrated to an air carrier inspector representing the Administrator or to a check pilot of the air carrier duly authorized by the Administrator, satisfactory capability with respect to the following:

(a) Familiarity with the aircraft, including demonstration of ability to maneuver such aircraft with the maximum authorized load for the route or part thereof; and, in addition, if the aircraft is multiengined, a demonstration of ability to maneuver such aircraft with said load, with any one engine fully throttled either:

(1) At an altitude equivalent to 1,000 feet above the highest part of the terrain on the proposed instrument course of the route or part thereof to be flown by the pilot in air carrier service, or

(2) At the one-engine-inoperative service ceiling.

(b) Familiarity with the route and with instruments, including demonstration of ability, under actual or simulated conditions, to fly such route solely by instruments.

(c) Familiarity with procedures, including demonstration of ability to accomplish a let-down-through by instruments, according to the procedure specified in the appropriate competency letter, at one station at least, on the route, in each type of aircraft to be used by the pilot in air carrier operation. Such demonstrations as to other stations as deemed necessary by the Administrator may be made to an air carrier inspector representing the Administrator, or to a check pilot of the air carrier duly authorized by the Administrator, under simulated conditions or by equivalent means approved by the Administrator.

[CAR, May 31, 1938, as amended by Amdt. 51, 5 F. R. 1838, and Amdt. 40-3, 14 F. R. 2196]

§ 40.183 *Second pilots.* Same as in § 40.88.

§ 40.184 *Aircraft dispatchers.* Same as in § 40.89.

MISCELLANEOUS REQUIREMENTS

§ 40.186 *Weather minimums.* Same as in § 40.101, giving consideration to the fact that no passengers are being carried in this operation and providing for the most rapid progress of the art of flying.

§ 40.187 *Air carrier operating skill.* Same as in § 40.102.

AIR CARRIER OPERATING CERTIFICATE

§ 40.191 *Application for and issuance of air carrier operating certificate.* (a) Application for an air carrier operating certificate shall be made upon the applicable forms prescribed and furnished by the Administrator.

(b) An air carrier operating certificate may be issued by the Administrator to an applicant after approval of application made and proof submitted in connection therewith, if the Administrator finds, after investigation, that such person is properly and adequately equipped and able to conduct a safe operation in accordance with the requirements of the act and the applicable rules, regulations, and standards prescribed thereunder for such operation.

[Amdts. 40-8, 40-9, 7 F. R. 1414]

§ 40.192 *Display.* The air carrier operating certificate shall be presented for inspection upon the request of any duly authorized representative of the Administrator or Board.

[Amdts. 40-8, 40-9, 7 F. R. 1414]

§ 40.193 *Duration.* An air carrier operating certificate shall be of indefinite duration unless canceled, suspended, or revoked.

[Amdts. 40-8, 40-9, 7 F. R. 1414]

§ 40.194 *Surrender.* Upon the cancellation, suspension, or revocation of an air carrier operating certificate, or part thereof, the holder shall, upon request, surrender such certificate, or part thereof, to any officer or employee of the Administrator.

[Amdts. 40-8, 40-9, 7 F. R. 1414]

§ 40.195 *Nontransferability.* An air carrier operating certificate is not transferable except with the written consent of the Administrator.

[Amdts. 40-8, 40-9, 7 F. R. 1414]

§ 40.196 *Inspection.* A duly authorized representative of the Administrator shall be permitted at any time and place to make such inspection or examination as may be deemed necessary to determine the operator's compliance with the requirements of the regulations in this subchapter and the Civil Aeronautics Act of 1938, as amended.

[Amdts. 40-8, 40-9, 7 F. R. 1414]

§ 40.197 *Amendment.* Application by the air carrier to amend the air carrier operating certificate shall be made upon the applicable form prescribed and furnished by the Administrator.

[Amdts. 40-8, 40-9, 7 F. R. 1414]

DEFINITIONS

§ 40.201 *Definitions.* (a) As used in this part the words listed below shall be defined as follows:

[Amdt. 40-3, 14 F. R. 2196]

§ 40.202 *Category.* Category shall indicate a classification of aircraft such as airplanes, helicopter, glider, etc.

[Amdt. 40-3, 14 F. R. 2196]

§ 40.203 *Flight time.* Flight time shall mean the total time from the moment the aircraft first moves under its own power for the purpose of flight until the moment it comes to rest at the end of the flight (block to block).

[Amdt. 40-3, 14 F. R. 2196]

§ 40.204 *Pilot in command.* Pilot in command shall mean the pilot responsible for the operation and safety of the aircraft during the time defined as flight time.

[Amdt. 40-3, 14 F. R. 2196]

§ 40.205 *Type.* Type shall mean all aircraft of the same basic design including all modifications thereto except those modifications which result in a change in handling or flight characteristics.

[Amdt. 40-3, 14 F. R. 2196]

PART 41—CERTIFICATION AND OPERATION RULES FOR SCHEDULED AIR CARRIER OPERATIONS OUTSIDE THE CONTINENTAL LIMITS OF THE UNITED STATES

AUTHORITY: §§ 41.0 to 41.137 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 601, 602, 604, 52 Stat. 1007, 1008, 1010; 49 U. S. C. 551, 552, 554.

SOURCE: §§ 41.0 to 41.137 contained in Amendment 41-0, Civil Air Regulations, 10 F. R. 8528, except as noted following sections affected.

CROSS REFERENCE: For Special Air Regulation Serial No. SR-325, with respect to temporary authorization for scheduled air transportation of cargo under Part 42, see Note 3 to Part 42 of this subchapter.

CERTIFICATE

§ 41.0 *General.* The regulations in this part are prescribed for scheduled air transportation operations conducted by air carriers between a place in any State of the United States, or the District of Columbia, and any place in a Territory or possession of the United States; or between any place in a Territory or possession and a place in any other Territory or possession of the United States; or between places in a Territory or possession, except the Philippine Islands; or between any place in the United States and any place outside thereof; or between any two places outside the United States.

§ 41.1 *Issuance.* An air carrier operating certificate prescribing the type of operation, the routes over which such operation may be conducted, the airports which may be used, and such other specifications and restrictions as may be reasonably required in the interest of safety shall be issued by the Administrator to an applicant who demonstrates that he is capable of conducting the proposed operations in accordance with the applicable regulations specified in this part.

(a) *Alaskan air carriers.* Whenever, upon investigation, the Administrator finds that the general standards of safety required for air carrier operations within the Territory of Alaska require or permit a deviation from any specific requirement of this part for a particular operation or a class of operations for which an application for an air carrier operating certificate has been made, he may issue an air carrier operating certificate with appropriate changes, specifying therein the period during which such deviations may be permitted. The Administrator shall promptly notify the Board of any deviations included in the air carrier operating certificates and the reasons therefor.

[Amdt. 41-0, 10 F. R. 8528 as amended by Amdt. 41-7, 12 F. R. 4932, and Amdt. 41-2, 13 F. R. 6554]

§ 41.2 *Compliance.* All operations shall be conducted in accordance with the specifications of the air carrier operating certificate and the rules contained in this part.

§ 41.3 *Duration.* An air carrier operating certificate will continue in effect until canceled, suspended, or revoked, after which it shall be surrendered to any officer or employee of the Administrator upon request.

§ 41.4 *Display.* The air carrier operating certificate shall be available at the appropriate operations office for inspection by any authorized representative of the Administrator or Board.

§ 41.5 *Inspection.* An authorized representative of the Administrator shall be permitted at any time and place to make inspections or examinations to determine the operator's compliance with the appropriate requirements of the regulations in this subchapter and the Civil Aeronautics Act of 1938, as amended.

PASSENGER OPERATION RULES

ROUTE REQUIREMENTS

§ 41.10 *Airport spacing.* In the case of operations employing aircraft having two engines, airports adequate for the aircraft used shall be located so that the aircraft, when flying along the route, will at no time be at a greater distance therefrom than 45 minutes flying at normal cruising speed, except where the Administrator finds that because of the character of the terrain, the type of operation, and the performance of aircraft used adequate safety will be provided with airports spaced at greater distances.

§ 41.11 *Communications facilities.* A two-way ground-to-aircraft radio communications system shall be available at such points as are necessary to insure adequate communication between plane and ground over the entire route.

§ 41.12 *Weather reporting services.* Weather reporting services shall be available at such points along the route as are necessary to insure sufficient weather reports prepared from observations made and released by a source acceptable to the Administrator.

§ 41.13 *Navigational facilities*—(a) *Short distance operation.* Except in the case of a day contact operation where the characteristics of the terrain are such that navigation can be accomplished by reference to landmarks, each route shall be equipped with radio navigational facilities so located as to permit navigation by such facilities over the entire route. For instrument operation a facility shall be so located with respect to each scheduled stop and required alternate airport as to provide adequate means for making an instrument approach. In day instrument operation such a facility is not required at an alternate used only when the weather conditions are as good as or better than: broken clouds, ceiling 1,000 feet, visibility 2 miles, with conditions stable or improving.

(b) *Long distance operation.* Each route shall be equipped with radio navigational facilities so located as to permit the obtaining of reliable radio bearings when within 200 miles of any regular or approved alternate airport and a facility shall be so located with respect to each such airport as to provide adequate means for making an instrument approach: *Provided,* That the Administrator, at particular airports, may approve facilities which provide less coverage than that required in this section if he finds that adequate safety is provided.

§ 41.14 *Airport lighting facilities.* For night operation each scheduled stop and required alternate airport shall be equipped with adequate lighting facilities.

AIRCRAFT REQUIREMENTS

§ 41.20 *General.* (a) Aircraft shall be certificated and equipped in accordance with the airworthiness requirements of this subchapter applicable to the type of operation conducted.

(b) Airplanes not certificated under the transport category requirements shall have such characteristics as to permit safe operation over the routes on which such airplanes will be operated.

(c) Land aircraft operated over water beyond gliding distance from shore without the aid of power shall be equipped with retractable landing gear.

(d) Multiengine airplanes shall be so equipped that engine rotation may be promptly stopped during flight.

(e) Operations which do not comply with the requirements of this part will be permitted to continue for the duration of the war and 12 months thereafter if the Administrator finds that such continuation is necessary to the maintenance of an established service and that it will create no undue hazard under the particular conditions existing.

(f) Irrespective of the basis for certification, all aircraft possessing engine(s) rated at more than 600 h. p. (each) for maximum continuous operation shall comply with the following, except that, if the Administrator finds that in particular types of existing aircraft literal compliance with specific items of these requirements might be extremely difficult of accomplishment and that such compliance would not contribute materially to the objective sought, he may accept such measures of compliance as he finds will effectively accomplish the basic objectives of this part:

(1) Sections 4b.58 and 4b.447 (a) of this subchapter.

(2) At the first major fuselage overhaul subsequent to May 1, 1947, but in any case not later than November 1, 1948, §§ 4b.442, 4b.445, 4b.447 (b), (c), (d), 4b.448 (b), and 4b.448 (c) of this subchapter.

(3) At the first major wing centersection overhaul subsequent to May 1, 1947, but in any case not later than November 1, 1948, §§ 4b.478, 4b.484, 4b.503, 4b.516 through 4b.518, 4b.556, 4b.557, 4b.560, 4b.561, 4b.586 and 4b.621 through 4b.624, 4b.651 through 4b.655, 4b.661 (a) and (c), and 4b.662 through 4b.676 of this subchapter.

[Amdt. 41-0, 10 F. R. 8528, as amended by Amdt. 41-3, 11 F. R. 11354, SR-385, 12 F. R. 408, Amdt. 41-18, 13 F. R. 1698, Amdt. 41-3, 14 F. R. 2196]

NOTE: Special Regulation Serial No. SR-329, effective Nov. 1, 1948, 13 F. R. 6537, provides as follows:

Notwithstanding the provisions of §§ 41.20, 42.10, and 61.30 of this subchapter establishing certain fire prevention standards requiring compliance on or before November 1, 1948, no air carrier shall be held in violation of these requirements prior to December 1, 1948. Upon application by the air carrier prior to December 1, 1948, the Administrator may further authorize an air carrier to operate without full compliance with these requirements where the Administrator finds that the air carrier has made a diligent effort to meet these requirements by November 1, 1948, and that the air carrier has shown that it will comply with these requirements by a date certain: *Provided,* That no air carrier shall be required to install or maintain smoke or fire detectors, other than heat detectors, unless otherwise directed by the Administrator.

Instruments and Equipment

§ 41.21 *Radio equipment; short distance operation.* (a) For day contact operations over routes on which navigation can be accomplished by visual reference to landmarks, each aircraft shall be equipped with such radio facilities as are necessary to accomplish the following:

(1) Transmit communications and meteorological information to at least one ground station from any point on the route and transmit, from a distance of not less than 25 miles, to airport traffic control towers located at airports approved for the route;

(2) Receive communications at any point on the route;

(3) By either of two independent means, receive meteorological information at any point on the route and receive instructions from airport traffic control towers located at airports approved for the route.

If appropriate, one of the means provided for compliance with subparagraph (3) of this paragraph may be employed for compliance with subparagraph (2).

(b) For day contact operations over routes on which navigation cannot be accomplished by visual reference to landmarks and for night contact, day or night instrument operations, each aircraft shall be equipped with such radio facilities as are necessary to accomplish the following:

(1) Transmit communications and meteorological information to at least one ground station from any point on the route and transmit, from a distance of not less than 25 miles, to airport traffic control towers located at airports approved for the route;

(2) Receive communications at any point on the route;

(3) By either of two independent means, receive meteorological information at any point on the route and receive instructions from airport traffic control towers located at airports approved for the route;

(4) By either of two independent means, satisfactorily receive radio navigational signals from any radio aid to navigation required by § 41.13 (a).

If appropriate, one of the means provided for compliance with subparagraph (3) of this paragraph may be employed for compliance with subparagraph (2) of this paragraph or the means provided for compliance with subparagraph (4) of this paragraph may be employed for compliance with subparagraph (3) of this paragraph.

§ 41.22 *Radio equipment; long distance operation.* Each aircraft shall be equipped with such radio facilities as are necessary to accomplish the following:

(a) By either of two independent means, transmit communications and meteorological information to at least one ground station from any point on the route and transmit, from a distance of not less than 25 miles, to airport traffic control towers located at airports approved for the route;

(b) By either of two independent means, receive communications at any point on the route;

(c) By either of two independent means, receive meteorological information at any point on the route and receive instructions from airport traffic control towers located at airports approved for the route;

(d) By either of two independent means, satisfactorily receive radio navigational signals from any radio aid to navigation required by § 41.13 (b).

If appropriate, equipment provided for compliance with paragraph (c) of this section may be employed for compliance with either paragraph (b) or this paragraph.

§ 41.23 *First-aid and emergency equipment.* Each aircraft shall be equipped with a conveniently accessible first-aid kit adequate for the type of operation involved. Aircraft scheduled over routes requiring flights for long distances over uninhabited terrain must carry such additional emergency equipment as the Administrator designates for the particular operation involved. All aircraft operated over water shall be equipped with life preservers or flotation devices readily available for each person aboard and with a Very pistol or equivalent signal equipment, except that this requirement will not apply when such operations consist only of landings, take-offs, or flights for short distances over water and the Administrator finds in each case that such equipment is not necessary. In addition, all aircraft operated for long distances over water shall be equipped with a sufficient number of life rafts to accommodate adequately all occupants and such additional emergency equipment as may be required by the Administrator.

§ 41.24 *Oxygen apparatus.* (a) Aircraft not having pressurized cabins and operated at an altitude exceeding 10,000 feet above sea level continuously for more than 30 minutes or at an altitude exceeding 12,000 feet above sea level for any length of time shall be equipped with effective oxygen apparatus and an adequate supply of oxygen available for the use of the operating crew. Such aircraft shall also be equipped with an adequate separate supply of oxygen available for the use of passengers when operated at an altitude exceeding 12,000 feet above sea level.

(b) Unless oxygen is supplied in accordance with paragraph (a) of this section, aircraft having pressurized cabins shall not be operated with a pressure within the cabin less than that corresponding to a pressure altitude of 10,000 feet. Aircraft having pressurized cabins and operated at altitudes in excess of 18,000 feet above sea level shall be equipped with an adequate emergency supply of oxygen available for the use of the flight crew.

§ 41.25 *Instruments and equipment required for continuance of flight.* If any required instrument or item of equipment in an aircraft becomes unserviceable in flight, a landing must be made at either the nearest suitable landing area or at the next point of intended landing whichever, in the opinion of the pilot, is the safer procedure, unless the equipment specified in this section for the type of operation indicated is in serviceable condition, in which case the flight may continue as scheduled to the nearest point where repairs or replacements can be made.

The items listed in this section are required for all types of operation unless otherwise specified:

(a) One air-speed indicator and one sensitive type altimeter (contact operation); two air-speed indicators and two sensitive type altimeters (instrument operation).

(b) One approved compass.

(c) A tachometer for one engine, one fuel pressure gauge with warning indicator, one oil pressure gauge with warning indicator, and one oil temperature or cylinder temperature gauge for each engine.

(d) A manifold pressure gauge for one engine.

(e) In addition to fire detecting and fire extinguishing equipment necessitated as a result of compliance with § 41.20 (f) (2) and (3), a minimum of two hand fire extinguishers of an approved type with an approved extinguishing agent, one of which installed in the crew compartment, others readily accessible to the passengers. Such additional hand fire extinguishers as the Administrator finds necessary for compliance with § 41.20 (f) (2).

(f) One landing gear position indicator or equivalent facility, if equipment includes a retractable landing gear.

(g) One or more storage batteries or other source of electrical supply sufficient to operate all radio and electrical equipment necessary for the flight.

(h) (1) Two of the following three units of radio equipment:

(i) One transmitter for two-way communication,

(ii) One receiver for two-way communication,

(iii) One receiver capable of receiving navigational signals.

(2) In addition to the instruments named in subparagraph (1) of this paragraph, one of the radio navigational systems required by § 41.21 (b), if navigational facilities on the route are required by § 41.13.

(i) All radio equipment required by these regulations (night and instrument operation).

(j) Forward position and tail lights, two landing lights, one set of instrument lights, and two landing flares each rated for at least 3-minute duration (night operation).

(k) Fuel quantity indicators indicating the amount of fuel in each tank to be used for the remainder of the flight (night and instrument operation).

(l) An electrically heated pitot tube serving each pilot's air-speed indicator (night and instrument operation).

(m) One gyro rate-of-turn indicator combined with a bank indicator, one artificial horizon indicator, and one gyro direction indicator (night and instrument operation).

(n) One outside air temperature gauge with indicating dial in the pilot compartment and one carburetor air temperature indicator or equivalent approved device (night and instrument operation).

(o) If vacuum system is used, one vacuum gauge with warning indicator on the instrument panel installed in lines leading to the rate-of-turn and artificial horizon indicators and the gyro direction indicator (night and instrument operation),

(p) One clock with sweep second hand (night and instrument operation),

(q) Three spare fuses of each capacity, or 25 percent of the number of each capacity, whichever is the greater.

[Amdt. 41-0, 10 F. R. 8528, as amended by Amdt. 41-3, 11 F. R. 11354]

Limitations

§ 41.26 *Aircraft certification limitations.* (a) Aircraft certificated as a basic type after June 30, 1942, shall be certificated in accordance with Part 4b of this subchapter, or the transport category requirements of Part 4a of this subchapter, and shall meet the requirements of § 41.27 over each route to be flown.

(b) Aircraft certificated as a basic type prior to June 30, 1942, shall either:

(1) Retain their present airworthiness certification status and shall be operated in accordance with such operating limitations as the Administrator finds will provide a safe relation between the performance of the aircraft and the dimensions of airports and terrain; or

(2) Qualify by showing compliance with either the performance requirements contained in §§ 4a.737-T through 4a.750-T, or the requirements contained in Part 4b of this subchapter, and when so qualified shall meet the requirements of § 41.27 over each route to be flown: *Provided,* That should any type be so qualified all aircraft of any one operator of the same or related types shall be similarly qualified and operated.

(c) Aircraft used after December 31, 1953, shall comply with all of the requirements of Part 4b of this subchapter, or the transport category requirements of Part 4a of this subchapter, and shall meet the requirements of § 41.27 over each route to be flown.

[Amdt. 41-16, 13 F. R. 747, Amdt. 41-3, 14 F. R. 2196]

§ 41.27 *Operating limitations upon airplanes certificated under transport category requirements.* When operating any airplane certificated in accordance with the provisions of §§ 4b.71 to 4b.171 of this subchapter, or of §§ 4a.737-T through 4a.750-T of this subchapter, the provisions of §§ 41.28-41.35 shall apply unless deviations therefrom are specifically authorized by the Administrator when he finds that, due to a peculiarity of a specific case, such application is unnecessary for safety.

In determining compliance with these provisions the data obtained in testing the airplane for type certification may be applied, by interpolation or by computation of the effects of changes in specific variables, to conditions differing from those for which specific tests were made, where such interpolations or computations will give results substantially equalling in accuracy the results of a direct test.

[Amdt. 41-0, 10 F. R. 8528, as amended by Amdt. 41-2, 11 F. R. 5996]

§ 41.28 *General limitations.* (a) Airplanes shall be operated only from airports at altitudes within the altitude range for which maximum take-off weights have been determined and set forth in the airplane operating manual and shall be dispatched only to airports of intended destination, or to airports specified as alternates, which are at altitudes within the range for which maximum landing weights have been determined and set forth in the airplane operating manual.

(b) The weight of an airplane at take-off shall not exceed the certificated maximum take-off weight for the altitude of the airport from which the take-off is made.

(c) The weight at take-off shall be such that, allowing for the consumption of the amount of fuel and oil which would normally be consumed in flight to the intended destination, the weight on arrival at the destination will not exceed the certificated maximum landing weight for the altitude of the airport of intended destination.

[Amdt. 41-0, 10 F. R. 8528, as amended by Amdt. 41-2, 11 F. R. 5997]

§ 41.29 *Take-off limitations to provide for engine failure.* Take-off shall be made only from such airports, in such directions, and under such weight limitations that the following conditions are fulfilled as shown by the performance data determined under § 4a.747-T or § 4b.91 of this chapter and set forth in the airplane operating manual:

(a) From any point on the take-off up to the time of attaining the critical-engine-failure speed set forth in the airplane operating manual it shall be possible to bring the airplane to a safe stop within the landing area, as shown by the accelerate-and-stop distance data.

(b) If the critical engine should fail at any instant after the airplane attains the critical-engine-failure speed, it shall be possible to proceed with the take-off and attain a height of 50 feet, as indicated by the take-off path data, before passing over the end of the take-off area. Thereafter it must be possible to clear all obstacles either by at least 50 feet vertically, as shown by the take-off path data, or by at least 200 feet horizontally within the airport boundaries and 300 feet horizontally after passing beyond such boundaries.

In determining the allowable deviation of the flight path in order to avoid obstacles, it is assumed that the airplane is not banked before reaching a height of 50 feet, as shown by the take-off path data, and that the maximum bank thereafter does not exceed 15°.

(c) In applying the requirements of paragraphs (a) and (b) of this section correction shall be made for any gradient of the take-off surface. Take-off data based on still air may be corrected to allow for the effect of a favorable wind which is equal to not more than 50 percent of the component along the take-off runway due to the reported wind condition.

[Amdt. 41-0, 10 F. R. 8528, as amended by Amdt. 41-2, 11 F. R. 5997, Amdt. 41-9, 12 F. R. 5865]

NOTE: Special Regulation Serial No. 397, Aug. 21, 1947, effective Sept. 6, 1947, 12 F. R. 5848, and subsequently made effective Oct. 15, 1947, by Special Regulation Serial 397A, 12 F. R. 6069, provides in part as follows:

For the individual model airplanes enumerated below, the take-off weight or the minimum length of runway, or both, and the critical-engine-failure speed, V_1, shall be further modified to include the following corrections. Correction values shall be applied by adding them algebraically, noting temperatures above the standard as positive, and noting those below the standard as negative.

Airplane	Correction to weight and/or runway length (use either column or combinations)		Correction to V_1
	Pounds/°F.	Feet/°F.	M. p. h./°F.
Lockheed 649, 749	−90	+9	−.10
Lockheed 49-46	−65	+6	−.07
C-54, DC-4	−90	+10	0
DC-6	−70	+10	0
Boeing SA-307B-1	−50	+9	−.08
Martin 202:			
Temp. above Std	−300	+12.5	0
Temp. below Std	−110	+15	0

§ 41.30 *En route limitations*—(a) *All airplanes; all engines operating.* Airplanes shall be dispatched only at such take-off weights that, in proceeding along the intended track with the weight of the airplane progressively reduced by the anticipated consumption of fuel and oil, the rate of climb with all engines operating (as set forth in the airplane operating manual), shall be, in feet per minute, 6 V_{s_0} at an altitude at least 1,000 feet above the elevation of the highest ground or obstruction within 10 miles of either side of the intended track; except that this requirement need not apply to airplanes certificated under the performance requirements of the regulations issued prior to November 9, 1945 (Part 4a of this subchapter).

(b) *All airplanes; one engine inoperative.* Airplanes shall be dispatched only at such take-off weights that in proceeding along the intended track with the weight of the airplane progressively reduced by the anticipated consumption of fuel and oil, the rate of climb with one engine inoperative (as set forth in the airplane operating manual), shall be, in feet per minute, 0.02 $V_{s_0}^2$ for airplanes having maximum take-off weights up to 40,000 pounds, increasing linearly to 0.04 $V_{s_0}^2$ at 60,000 pounds, and 0.04 $V_{s_0}^2$ for maximum take-off weights above 60,000 pounds at an altitude at least 1,000 feet above the elevation of the highest ground or obstruction within 10 miles of either side of the intended track; except that for airplanes certificated under the performance requirements of the regulations issued prior to November 9, 1945 (Part 4a of this subchapter) the above rate-of-climb value may be 0.02 $V_{s_0}^2$ irrespective of maximum take-off weight.

(c) *Airplanes with four or more engines; two engines inoperative.* If from any point along the track flown, more than 90 minutes at "all-engines-operating" cruising speed is required to reach an available landing area where the provisions of § 41.33 as modified by § 41.34 can be met at the airplane weight estimated to exist upon arrival there, an aircraft with four or more engines shall not be dispatched over such track unless its weight is such as to permit a rate of climb with two engines inoperative (as set forth in the airplane operating manual), in feet per minute, of 0.01 $V_{s_0}{}^2$ at an altitude of at least 1,000 feet above the elevation of the highest ground or obstruction within 10 miles on either side of the intended track to the landing area, or at 5,000 feet, whichever is higher; except that this requirement need not apply to airplanes certificated under the performance requirements of the regulations issued prior to November 9, 1945 (Part 4a of this subchapter). This specified rate of climb shall correspond to the airplane's weight attained at the moment of failure of the second engine (assumed to occur 90 minutes from time of departure), or to the weight which may be attained by dumping fuel at the moment of failure of the second engine, provided that sufficient fuel is retained aboard the airplane to reach a point 1,000 feet directly above the landing area.

(d) *Special air navigation facilities.* Where special air navigation facilities provide for reliable and accurate identification of high ground or obstruction extending for less than 20 miles along the track, the lateral distance of 10 miles specified in § 41.30 (a), (b), (c) may be reduced to 5 miles.

[Amdt. 41-2, 11 F. R. 5997]

§ 41.33. *Landing distance limitations.* (a) An airplane shall be dispatched only under such conditions that it would be possible, as shown by the still-air landing data obtained in § 4b.111 of this subchapter, or § 4a.750-T of this subchapter and set forth in the airplane operating manual, at a weight corresponding to the maximum weight expected to exist at the time of arrival at the airport of intended destination, and under standard air conditions for the altitude of such airport, to bring the airplane to rest from a point 50 feet directly above the intersection of the obstruction clearance line (as defined in § 41.35) and the landing surface, within a total distance not in excess of 60 percent of the effective length of the landing area (as defined in § 41.35) most suitable for landing in still air.

(b) For every anticipated condition of wind velocity and direction and the corresponding landing direction required at the airport of intended destination by the ground handling characteristics of the airplane type involved, the ratio of landing distance to effective length of landing area shall not be greater than that as specified in paragraph (a) of this section, after allowing for the effect on the landing path and roll of not more than 50 percent of the favorable wind component due to a particular wind condition.

(c) If the requirement of paragraph (a) of this section can be met, but the requirement of paragraph (b) of this section cannot be fully met, at an airport of intended destination, a flight to such airport may be dispatched if at least one approved alternate airport is designated in the flight plan at which the requirements of paragraphs (a) and (b) of this section, as modified by § 41.34, are met.

[Amdt. 41-0, 10 F. R. 8528, as amended by Amdt. 41-2, 11 F. R. 5997]

§ 41.34 *Landing distance at alternate fields.* The conditions of § 41.35 will apply with respect to alternate airports specified in the flight plan, except that in the case of alternate airports the landing distance as defined in that section shall not exceed 70 percent of the effective length of the landing area.

§ 41.35 *Definition of effective length of landing area.* The effective length of the landing area is the distance from the point where the obstruction clearance line, as defined below, intersects the landing surface to the far end of the landing area.

The obstruction clearance line is a line drawn tangent to or clearing all obstructions showing in a profile of the approach area as defined below. The obstruction clearance line is further limited by having a slope to the horizontal of 1:20 as it approaches the landing area.

The approach area, as used in this section, shall be an area symmetrical about a center line coinciding with and prolonging the center line of the runway, except that where there is a multiplicity of parallel runways or a large area continuously available for landing, the center line of the approach area shall coincide with the most probable landing path for instrument approaches. The approach area shall be considered as extending longitudinally from the landing area out to the most remote obstacle touched by the obstruction clearance line, assuming the center line of the approach area in plan view to be straight for at least 1,500 feet from the intersection of the obstruction clearance line with the landing surface and thereafter continuing in a path consistent with the instrument approach procedures for the runway in question, or, where such procedures are not specified, consistent with turns of at least 4,000 feet in radius; and as extending laterally to a distance of 200 feet on either side of its center line at the point of intersection of the obstruction clearance line with the landing surface, with this distance increasing uniformly to 500 feet on either side of the center line of the area at a longitudinal distance of 1,500 feet from the intersection of the obstruction clearance line with the landing surface, and maintaining a distance of 500 feet from the center line thereafter.

[Amdt. 41-0, 10 F. R. 8528, as amended by 41-2, 11 F. R. 10650]

Maintenance

§ 41.38 *Maintenance organization.* The air carrier is responsible for the continuous airworthiness of all aircraft, engines, propellers, and appliances. Unless maintenance is performed by another agency under a contract approved by the Administrator, it is responsible for maintaining adequate maintenance facilities, the adequacy and competence of maintenance personnel, and for the preparation of such maintenance reports as are required by the Administrator.

§ 41.39 *Alterations and repairs.* Aircraft, engines, propellers, and appliances must be altered or repaired only in conformity with the procedures and, insofar as they apply, the methods provided for in Part 18 of this subchapter. Reports of such alterations or repairs must be submitted promptly to the Administrator.

§ 41.40 *Inspection.* The air carrier shall maintain an inspection organization which is responsible for determining that all maintenance conforms to at least the minimum standards prescribed by the Administrator as to workmanship, methods employed, and materials used. Each inspector must hold a valid mechanic certificate and rating for the type of inspection involved.

§ 41.41 *Maintenance manual.* The air carrier shall prepare and maintain a manual for the use and guidance of maintenance personnel which contains full information pertaining to the repair and service of flight equipment and clearly outlines the responsibilities of maintenance personnel. It must be in a form approved by the Administrator and copies furnished to all persons designated by the Administrator or Board. All copies in the hands of designated company personnel must be kept up to date.

(a) *Changes.* The extension of any overhaul, check, or inspection period must have the written approval of the Administrator. Other changes in the maintenance manual may be made without the prior approval of the Administrator, if such changes are not inconsistent with any Federal regulation, the air carrier operating certificate, or safe maintenance practice.

§ 41.42 *Training program.* The air carrier must provide for the proper and periodic instruction of all maintenance personnel, particularly in connection with the introduction into service of new or unfamiliar equipment.

§ 41.43 *Records.* Current records shall be kept of the total time in service, the time since last overhaul, and the time since last inspection on all aircraft components, engines, propellers, and where practicable, on instruments, equipment, and accessories.

§ 41.44 *Cockpit check list.* (a) The air carrier shall provide for each type aircraft a cockpit check list, approved by the Administrator, adapted to each operation in which the aircraft is to be utilized. An approved check list shall be installed in a readily accessible location in the cockpit of each aircraft and shall be appropriately used by the flight crew for each flight.

(b) The cockpit check list shall include procedures prior to starting engines, prior to take-off, prior to landing, and for power-plant emergencies.

[Amdt. 41-20, 13 F. R. 2159, as amended by Amdt. 41-3, 14 F. R. 2196]

AIRMAN RULES

Pilot

§ 41.48 *Certificate.* (a) Any pilot serving as pilot in command shall hold a valid air-line transport pilot certificate and a rating for the aircraft in which he is to serve.

(b) Any pilot serving as copilot in an aircraft requiring two pilots shall hold at least a commercial pilot certificate and instrument rating and must have demonstrated to an air carrier inspector of the Administrator, or to an authorized check pilot of the air carrier, his ability to take off and land aircraft in which he is to serve.

(c) Any pilot serving as copilot in an aircraft requiring three or more pilots shall meet the requirements of paragraph (a) of this section: *Provided*, That until June 1, 1946, any pilot may serve as copilot in an aircraft requiring three or more pilots, if he holds at least a commercial pilot certificate and instrument rating and has demonstrated to an air carrier inspector of the Administrator or to an authorized check pilot of the air carrier his ability to take off and land aircraft in which he is to serve.

(d) Any pilot serving in a pilot capacity other than as pilot in command or copilot shall meet the requirements of paragraph (b) of this section.

[Amdt. 41-0, 10 F. R. 8528, as amended by Amdt. 41-2, 10 F. R. 11227, Amdt. 41-3, 11 F. R. 3153, Amdt. 41-3, 14 F. R. 2196]

§ 41.49 *Number of pilots required.* The number of pilots required shall be sufficient to provide adequate safety. The type of aircraft used, the type of operation involved, and the duration of flights between points where flight crews are changed shall be the basis for making this determination.

§ 41.50 *Requirements for pilot route qualification.* A pilot qualifying on any route must be certified by a check pilot as qualified for the route and shall have accomplished at least the applicable procedures prescribed below:

(a) A pilot who has served as pilot in command for less than 1,000 hours shall have made, within the preceding 12 calendar months, 4 one-way trips over the route as pilot without passengers or as copilot with or without passengers. One of the above trips must have been completed within the preceding 60 days, and the pilot qualifying must have been accompanied on this trip by a check pilot.

(b) A pilot in command who has served as such on any route or routes for at least 1,000 hours, in order to qualify for any other route, shall have made, within the preceding 12 calendar months, 2 one-way trips as pilot without passengers or as copilot with or without passengers. One of the above trips must have been completed within the preceding 60 days, and the pilot qualifying must have been accompanied on this trip by a check pilot.

(c) In complying with the requirements of paragraphs (a) and (b) of this section, the qualifying pilot shall have performed in flight, under actual or simulated instrument conditions, all of the approved instrument approach procedures at each regular, provisional, and refueling and holding airport approved for the route. In the case of airports used only as alternates, the pilot may demonstrate his ability by other means approved by the Administrator.

(d) In the case of minor extensions or modifications of existing routes the provisions of paragraphs (a) and (b) of this section will not apply, unless found necessary by the Administrator in the interest of safety.

(e) In the case of new regular, provisional, or refueling and holding airports approved for a route, a pilot in command currently qualified for the route need not be required to perform the approach procedures specified in paragraph (c) of this section if the Administrator finds in each case that such procedure is unnecessary in the interest of safety.

[Amdt. 41-0, 10 F. R. 8528, as amended by Amdt. 41-3, 14 F. R. 2196]

§ 41.51 *Maintenance of pilot route qualification.* A pilot in command shall not serve as such over a particular route unless he has either:

(a) Made at least one one-way trip over the route as pilot in command or copilot within the preceding 12 calendar months, or

(b) After an absence from the route of more than 12 consecutive months, requalified in accordance with the appropriate provisions of § 41.50.

[Amdt. 41-0, 10 F. R. 8528, as amended by Amdt. 41-3, 14 F. R. 2196]

§ 41.52 *Maintenance of pilot technique.* If within any 90-day period a pilot in command or copilot has not made at least three take-offs and landings in aircraft of a particular type, such person shall not thereafter serve as a pilot in command or copilot in aircraft of that type in scheduled air transportation without having made at least three take-offs and landings in such aircraft with not less than one-half the maximum useful load. If he is to serve in air transportation at night at least one of the three take-offs and landings specified above must have been made at night.

[Amdt. 41-0, 10 F. R. 8528, as amended by Amdt. 41-3, 14 F. R. 2196]

§ 41.53 *Periodic flight checks and instruction.* Each air carrier must provide a sufficient number of check pilots to insure that each pilot in command employed continues to meet the minimum requirements both with regard to route competency and technique. Each of these checks must be accomplished twice each year at intervals of not less than four months. Periodic instruction must be given all pilots. In the case of pilots in command, instruction must include the obtaining of optimum performance under simulated maximum authorized weight conditions with one engine inoperative and instrument approach procedures and landings under the same conditions in the type aircraft in which such pilots serve in scheduled air transportation. In the case of all pilots other than pilots in command, instruction must include familiarization with the operations manual, with the types of equipment used, and with the duties of a copilot.

[Amdt. 41-0, 10 F. R. 8528, as amended by Amdt. 41-3, 14 F. R. 2196]

§ 41.54 *Flight time limitations for aircraft having a crew of one or two pilots.* (a) A pilot may be scheduled to fly 8 hours or less during any 24 consecutive hours without a rest period during such 8 hours. If a pilot is scheduled to fly in excess of 8 hours during any 24 consecutive hours, he shall be given an intervening rest period at or before the termination of 8 scheduled hours of flight duty. Such rest period must equal at least twice the number of hours flown since the last preceding rest period and in no case will such rest period be less than 8 hours. During such rest period the pilot must be relieved of all duty with the air carrier.

(b) When a pilot has flown in excess of 8 hours during any 24 consecutive hours he must receive at least 18 hours of rest before being assigned any duty with the air carrier.

(c) A pilot shall not fly in excess of 32 hours during any 7 consecutive days. Relief from all duty for not less than 24 consecutive hours must be provided for and given to a pilot at least once during any 7 consecutive days.

(d) A pilot shall not fly as a member of the crew more than 100 hours during any one month: *Provided*, That the Administrator is authorized, during the present war and until 6 months after the termination thereof, to permit the maximum of 100 hours to be exceeded to the extent necessary to complete a particular flight for military purposes.

(e) A pilot shall not fly as a member of the crew more than 1,000 hours in any 12-month period: *Provided*, That this limitation will not be effective during the present war and until 6 months after the termination thereof, and that during this period the maximum flying hours permitted in any 12-month period will be controlled by the provisions of paragraph (d) of this section.

§ 41.55 *Flight time limitations for aircraft having two pilots and one additional flight crew member.* (a) A pilot may not be scheduled to fly a total of more than 12 hours during any 24 consecutive hours.

(b) When a pilot has flown 20 hours or more during any 48 consecutive hours, or 24 hours or more during any 72 consecutive hours, he must receive at least 18 hours of rest before being assigned to any duty with the air carrier. In any case each pilot shall be relieved from all duty for not less than 24 consecutive hours during any 7 consecutive days.

(c) A pilot shall not fly as a member of the flight crew more than 120 hours in any 30 consecutive days or 300 hours in any 90 consecutive days: *Provided*, That the Administrator is authorized, during the present war and until 6 months after the termination thereof, to permit the above maximums of 120 or 300 hours to be exceeded to the extent necessary to complete a particular flight for military purposes.

(d) A pilot shall not fly as a member of the flight crew more than 1,000 hours in any 12-month period: *Provided*, That this limitation will not be effective during the present war and until 6 months after the termination thereof and that during this period a maximum of 1,200 flying hours will be permitted.

NOTE: Interpretation 1, 14 F. R. 1409, provides in part as follows:

Minimum crew complement; flight radio operators. We have been asked for an interpretation of the effect of Civil Air Regulations Amendment 41-1, dated October 5, 1948, on the minimum number of flight radio operators required on a scheduled flight of over 12 hours from airport to airport, where radiotelegraphy is necessary for communication with ground stations over a route segment of the flight which is less than 12 hours in length.

Section 41.70 of the Civil Air Regulations provide that, "when one flight radio operator is required the flight-time limitations prescribed in § 41.55 apply. When two or more flight radio operators are required, the flight-time limitations of § 41.56 apply." Section 41.55 states that where a crew consists of two pilots and an additional flight crew member, a "pilot may not be scheduled to fly more than 12 hours during any 24 consecutive hours." Since aircraft with which the regulation is concerned require two pilots at the controls at practically all times, the phrase "scheduled to fly" as used in this section does not necessitate precise definition with respect to the flight time of pilots since they are on duty throughout the flight. However, the expression is ambiguous when applied to radio operators whose duty watch, from a safety standpoint, need not in all instances be continuous from airport to airport while the aircraft is in the air. As applied to such airmen the term "to fly" when used as part of the phrase "scheduled to fly," may be interpreted in two possible ways—it may mean the entire time the aircraft is in the air, or it may mean the time the radio operator is on flight duty on the aircraft.

In dealing with this problem it is necessary to bear in mind that the Board's power over maximum hours of service of airmen derives from section 601 (a) of the Civil Aeronautics Act and relates solely to promoting safety of flight in air commerce. It is evident that the Board does not consider that an airman's being in the air for more than 12 hours creates a hazardous condition in and of itself, for exactly such a situation is contemplated in § 41.56 with respect to pilots. In effect, what is required by that section is that when the flight is to be of more than 12 hours' duration, provision be made for a relief pilot to permit the captain and first officer to be relieved from time to time of the strain of a continuous flight watch. The same principle is applicable to radio operators. Where the radio operator's flight watch is scheduled for more than 12 hours in a given 24, it is apparent that a second operator must be carried to relieve the first. However, what is essential is that after 12 hours of duty the radio operator be relieved, not that he be relieved by another operator, and consequently, if such relief is afforded by reason of the fact that the radio operator's services are not required for the operation of the aircraft for more than 12 hours, the same safety standard would appear to have been met.

Prior to the adoption of Amendment 41-1 on October 5, 1948, which specifically defined what was intended by "route segment," it may not have been clear in all cases when a radio operator was required to be on flight duty under the regulation. However, since the adoption of § 41.137 (q), the Administrator is permitted to specify the exact limits of a route segment, which may be considerably more confined than the route between the airports of take-off and landing for the flight. Thus, under the regulations, the time scheduled over the route segment or segments for which the Administrator has determined radio telegraphy is necessary represents the minimum on-duty time for which a flight radio operator is required. If the air carrier desires to maintain a radio flight watch beyond the minimum time thus prescribed or to utilize the services of the airmen in some other certificated capacity on the flight, of course, the time so spent must be included as part of the airman's on-duty flight time.

Accordingly, we interpret "scheduled to fly" as used in § 41.55 and as applied to radio operators as meaning "scheduled for flight duty on the aircraft." Thus, only one flight radio operator is required on a scheduled flight over 12 hours from airport to airport where such operator is only required or assigned for duty as an airman over a route segment which is less than 12 hours in length.

§ 41.56 *Flight time limitations for aircraft having three or more pilots and an additional flight crew member.* (a) Flight hours shall be scheduled in such a manner as to provide for adequate rest periods on the ground while the pilot is away from his base. Adequate sleeping quarters on the aircraft must be provided in all cases where a pilot is scheduled to fly more than 12 hours during any 24 consecutive hours.

(b) A pilot, upon return to his base from any flight or series of flights, shall receive a rest period of not less than twice the total number of hours flown since the last rest period at his base and during such period will not be required to perform any duty for the company. When the required rest period exceeds 7 days, that portion of the rest period in excess of 7 days may be given at any time before the pilot is again scheduled for flight duty on any route.

(c) A pilot shall not fly as a member of the flight crew more than 350 hours in any 90 consecutive days.

(d) A pilot shall not fly as a member of the flight crew more than 1,000 hours in any 12-month period: *Provided,* That this limitation will not be effective during the present war and until 6 months after the termination thereof, and that during this period a maximum of 1,200 flying hours will be permitted.

§ 41.57 *Flight time limitations for pilots not regularly assigned.* A pilot not regularly assigned as a flight crew member for an entire month under the provisions of § 41.55 or § 41.56 must not fly in excess of 100 hours in any 30 consecutive days.

§ 41.58 *Deadhead transportation.* The time spent in deadhead transportation to or from duty assignment will not be considered a part of any rest period.

§ 41.59 *Other commercial flying.* A pilot shall not do other commercial flying while employed by an air carrier when such flying, in addition to that in scheduled air transportation service, will exceed any flight time limitations specified herein.

§ 41.60 *Logging flight time.* (a) A pilot in command may log the total flight time elapsing during his command of the aircraft.

(b) A copilot holding an air-line transport pilot certificate and rating for the aircraft flown may log the total time during which he serves as copilot.

(c) A copilot not holding an air-line transport pilot certificate and rating for the aircraft flown may log 50 percent of the total flight time.

(d) Additional pilots when required, and serving as such, may log 50 percent of the total flight time.

[Amdt. 41-0, 10 F. R. 8528, as amended by Amdt. 41-3, 14 F. R. 2196]

§ 41.61 *Logging instrument flight time.* Instrument flight time may be logged as such by the pilot actually manipulating the controls only when the aircraft is flown solely by reference to instruments either under actual or properly simulated flight conditions.

§ 41.62 *Pilots at controls.* In the case of aircraft requiring two or more pilots, two pilots shall remain at the controls at all times while the aircraft is taking off, landing, and while en route, except when the absence of one is necessary in connection with his regular duties or when he is replaced by a person authorized under the provisions of § 41.121.

§ 41.63 *Pilot in command rules*—(a) *Pilot in command.* The pilot in command is in command of the aircraft at all times during flight and is responsible for the safety of persons and goods carried and for the conduct and safety of members of the crew.

(b) *Emergency decisions.* (1) The pilot in command is authorized to follow any course of action which appears necessary in emergency situations which, in the interest of safety, require immediate decision and action. He may, in such situations, deviate from prescribed methods, procedures, or minimums to the extent required by considerations of safety. When such emergency authority is exercised the pilot shall keep the proper control station fully informed regarding the progress of the flight. He shall submit a written report of any such deviation to the Administrator of Civil Aeronautics within 7 days after the completion of the trip.

(2) In an emergency requiring either the dumping of fuel or a landing at a weight in excess of the authorized landing weight the pilot in command may elect to follow whichever procedure he considers safer.

(c) *Flight equipment.* Before any flight is started the pilot in command shall have readily available in the aircraft appropriate and current flight and navigational facility maps, including instrument procedures when instrument flight is authorized, and such other equipment as may be necessary to properly conduct the proposed flight.

[Amdt. 41-0, 10 F. R. 8528, as amended by Amdt. 41-3, 14 F. R. 2196]

§ 41.64 *Compliance with foreign air traffic rules and local airport rules.* Pilots flying in the airspace of any foreign country shall, at all times, comply with the air traffic rules of the foreign government and with local airport rules, except where any rule prescribed herein is more restrictive and may be followed without violating the laws or rules of such country.

§ 41.65 *Composition of flight crew.* (a) No air carrier shall operate an aircraft with less than the minimum flight crew required for the type of operation and the type aircraft as determined by the Administrator in accordance with the standards prescribed in this part and specified in the air carrier operating certificate for each route or route segment.

(b) Where the provisions of this part require for a particular route, route segment, or aircraft the performance of two or more functions for which an airman certificate is necessary, such requirement shall not be satisfied by the performance of multiple functions at the same time by any airman over such route or route segment.

[Amdt. 41-1, 13 F. R. 5909, as amended by Amdt. 41-3, 14 F. R. 2196]

Flight Radio Operator

§ 41.68 *Flight radio operator; when required.* An airman holding a flight radio operator certificate shall be required for flight over any area, route, or route segment over which the Administrator has determined that radiotelegraphy is necessary for communication with ground stations during flight.

[Amdt. 41-1, 13 F. R. 5909]

§ 41.69 *Certificate.* Effective November 15, 1947, each flight radio operator shall hold a valid flight radio operator certificate issued in accordance with the provisions of Part 33 of this subchapter.

[Amdt. 41-6, 12 F. R. 3030]

§ 41.70 *Flight time limitations.* When one flight radio operator is required the flight time limitations prescribed in § 41.55 apply. When two or more flight radio operators are required the flight time limitations of § 41.56 apply.

§ 41.71 *Other flight crew members to be qualified.* In all flights requiring only one flight radio operator, one other flight crew member must be capable of operating the equipment in an emergency.

§ 41.72 *Qualification for duty.* A certificated flight radio operator shall not be assigned to nor perform duties for which he is required to be certificated unless, within the preceding 12-month period, he has had at least 4 months of satisfactory experience as a radiotelegraph operator and 25 hours of experience in the operation of aircraft radio during flight; or until the air carrier has checked the airman and has determined that he is (a) familiar with all current radio information pertaining to the routes to be flown and (b) competent with respect to the operating procedures and radio equipment to be used.

[Amdt. 41-12, 12 F. R. 6377]

Flight Engineer

§ 41.73 *Flight engineer; when required.* After December 1, 1948, an airman holding a flight engineer certificate shall be required on all four-engine aircraft certificated for more than 80,000 pounds maximum take-off weight, and on all other four-engine aircraft certificated for more than 30,000 pounds maximum take-off weight where the Administrator finds that the design of the aircraft used or the type of operation is such as to require a flight engineer for the safe operation of the aircraft.

[Amdt. 41-1, 13 F. R. 5909]

§ 41.74 *Certificate.* Effective November 15, 1947, each flight engineer shall hold a valid flight engineer certificate issued in accordance with the provisions of Part 35 of this subchapter.

[Amdt. 41-5, 12 F. R. 1919, Amdt. 41-10, 12 F. R. 6286]

§ 41.75 *Qualification for duty.* A certificated flight engineer shall not be assigned to nor perform duties for which he is required to be certificated unless, within the preceding 12-month period, he has had at least 50 hours of experience as a flight engineer on the type aircraft on which he is to serve; or until the air carrier has checked the airman and determined that he is (a) familiar with all current information and operating procedures relating to the type aircraft to which he is to be assigned and (b) competent with respect to such aircraft.

[Amdt. 41-12, 12 F. R. 6377, as amended by Amdt. 41-3, 14 F. R. 2196]

§ 41.76 *Flight time limitations.* When one flight engineer is required, the flight time limitations prescribed in § 41.55 apply. When two or more flight engineers are required, the flight time limitations prescribed in § 41.56 apply.

§ 41.77 *Other flight crew members to be qualified.* In all flights requiring the use of only one flight engineer, one other flight crew member must be capable of performing the duties of such engineer in an emergency during flight.

Flight Navigator

§ 41.80 *Flight navigator; when required.* An airman holding a flight navigator certificate shall be required for flight over any area, route, or route segment when the Administrator has determined either that celestial navigation is necessary or that other specialized means of navigation necessary for the safe conduct of flight cannot be adequately accomplished from the pilot station.

[Amdt. 41-1, 13 F. R. 5909]

§ 41.81 *Flight time limitations.* The flight time limitations prescribed in § 41.56 apply.

§ 41.82 *Qualification for duty.* A certificated flight navigator shall not be assigned to nor perform duties for which he is required to be certificated unless, within the preceding 12-month period, he has had at least 50 hours experience as a flight navigator; or until the air carrier has checked the airman and determined that he is (a) familiar with all current navigational information pertaining to the routes to be flown and (b) competent with respect to the operating procedures and navigational equipment to be used.

[Amdt. 41-12, 12 F. R. 6378]

Dispatcher

§ 41.84 *Number and location.* The air carrier shall provide an adequate number of certificated aircraft dispatchers located at such points as may be necessary to insure safe operations.

§ 41.85 *Certificate.* Each dispatcher shall hold a valid aircraft dispatcher certificate issued in accordance with the provisions of Part 27 of this subchapter.

§ 41.86 *Qualification for route.* Each dispatcher within 6 months immediately preceding his qualification for a route, or part thereof, shall have made at least one trip over the route on which he is to serve prior to dispatching any aircraft. In addition he must be familiar with:

(a) The contents of the air carrier operations manual;

(b) The radio facilities in the aircraft used; and

(c) With respect to the route, the following:

(1) The prevailing weather phenomena,

(2) The sources of weather information available,

(3) All phases of the air carrier operation,

(4) The maximum authorized loads for the aircraft used,

(5) The peculiarities and limitations of each radio navigational facility and similar information with regard to such additional facilities located off the route as are approved for use in obtaining fixes by means of cross bearings, and

(6) The effect of weather conditions on the radio reception of the aircraft used.

§ 41.87 *Maintenance of qualification.* Each dispatcher shall maintain his familiarity with the route or routes on which he dispatches aircraft.

§ 41.88 *Route qualification expiration.* After 24 consecutive months of absence from dispatching duty over a route or part thereof, a dispatcher will no longer be considered qualified to dispatch aircraft over such route.

FLIGHT OPERATION RULES

Dispatching Rules

§ 41.92 *Dispatching rules*—(a) *Short distance operation.* Flights may be dispatched over any approved route between two terminal points.

(b) *Long distance operation.* Flights may be dispatched over any track between two terminal points within the route approved by the Administrator for the operation.

§ 41.93 *Dispatching authorization.* Flights shall be started only on the authority of an aircraft dispatcher qualified for the route. In short distance operation this authority is not required at intermediate points specified in the original clearance unless the flight is delayed more than 30 minutes at any such point. In long distance operation redispatch is not required unless the flight is delayed more than 6 hours.

§ 41.94 *Dispatcher duty period.* A dispatcher may clear a flight only when he has been on duty at the station from which the clearance is effected for a period of time sufficient to become familiar with existing conditions. He must continue on duty until the aircraft has landed in completion of a trip, or has proceeded beyond his jurisdiction, or until he has been properly relieved by another qualified dispatcher.

§ 41.95 *Use of weather reports and forecasts in dispatch.* (a) Weather reports used to control flight movements shall be prepared from observations made and released by a source acceptable to the Administrator.

(b) Weather reports used shall be the latest reports available. Weather reports, other than off-course or on-call reports made a part of the clearance form, shall not be more than one hour and 30 minutes old at the time the aircraft departs.

(c) Weather forecasts made by the United States Weather Bureau, in the case of dispatch from points within the United States, or other sources acceptable to the Administrator, in the case of dispatch from points outside of the United States, shall be taken into account.

§ 41.96 *Weather minimums*—(a) *Dispatch under contact flight rules, short distance operations.* Aircraft may be dispatched only if current weather reports and forecasts show a trend indicating that the ceilings and visibilities along the route to be flown are, and will remain, at or above the minimums required for flight under contact flight rules until the flight arrives at the next point of intended landing specified in the clearance.

(b) *Instrument or over-the-top dispatch, short distance operations.* Aircraft may be dispatched only if the observed weather information and current weather forecasts pertaining to the next point of intended landing specified in the clearance show a trend indicating that the ceiling and visibility will be at or above the minimums specified when the flight is scheduled to arrive; and at least one alternate airport, meeting the minimum weather requirements for the airport when used as an alternate, is designated in the clearance.

(c) *Dispatch, long distance operation.* Aircraft may be dispatched only in compliance with the following conditions:

(1) The current weather forecasts must indicate that the ceiling and visibility either at the next point of intended landing or at any required alternate therefor will be at or above the approved minimums at the time the flight is estimated to arrive.

(2) In the case of overwater flights or any other flight where the point of intended landing has no available alternate, the current weather forecasts must also indicate that the ceiling and visibility either at the point of departure or at any required alternate therefor will be above the approved minimums at the time of arrival back to such point from any point along the route closer than the point-of-no-return.

§ 41.97 *Icing conditions.* Aircraft shall not be dispatched or flown into known heavy icing conditions and may be dispatched or flown into any less serious icing condition only if the aircraft is equipped for de-icing wings, propellers, and such other parts of the aircraft as are essential to safety.

§ 41.98 *Fuel supply*—(a) *Short distance contact operation.* An aircraft may be dispatched or take off only if it carries sufficient fuel, considering the wind and other weather conditions expected, to (1) fly to the next point of landing specified in the clearance and thereafter (2) for a period of at least 45 minutes at normal cruising consumption.

(b) *Short distance instrument or over-the-top operation.* An aircraft may be dispatched or take off only if it carries sufficient fuel, considering the wind and other weather conditions expected, to fly to the next point of landing specified in the clearance; and thereafter (1) to fly to and land at the most distant alternate airport designated for that point in the clearance; and thereafter (2) to fly for a period of at least 45 minutes at normal cruising consumption.

(c) *Long distance operation.* An aircraft may be dispatched or take off only if it carries sufficient fuel, considering the wind and other weather conditions expected, to fly to the next point of landing specified in the clearance; and thereafter (1) to fly to and land at the most distant alternate airport designated for that point in the clearance; and thereafter (2) to fly for a period of at least two hours at normal cruising consumption. An aircraft may be redispatched to return to the point of departure or to an alternate airport for that point only when such redispatch is accomplished while the aircraft has sufficient fuel to return to such point and thereafter to fly for a period of at least two hours at normal cruising consumption. In the case of a route approved without an available alternate for a particular stop, an aircraft dispatched to that point must carry sufficient fuel, considering wind and other weather conditions expected, to fly to that point and thereafter for at least 3 hours at normal cruising consumption. The Administrator may require fuel in excess of any of the minimums specified in this paragraph when he finds that additional fuel is necessary on a particular route in the interest of safety and, in the case of an overland operation where adequate intermediate airports and navigational facilities are available, may permit the operation to be conducted with the fuel reserves specified in paragraph (b) of this section.

§ 41.99 *Maintenance release, clearance, and load manifest forms.* All maintenance release, clearance, and load manifest forms used shall be approved by the Administrator. The original copies of such forms shall be given to the pilot in command and duplicate copies kept in the station file for at least 90 days.

[Amdt. 41-14, 12 F. R. 7994, as amended by Amdt. 41-3, 14 F. R. 2196]

§ 41.100 *Preparation of maintenance release form.* A maintenance release form shall be prepared for each aircraft delivered by the maintenance department to the operations department. This form must be signed by personnel of the air carrier charged with the duty of supervising the maintenance of the aircraft.

[Amdt. 41-14, 12 F. R. 7994]

§ 41.101 *Preparation of clearance form.* A clearance form shall be prepared for each flight between specified clearance points. The information for such clearance shall be prepared by the authorized aircraft dispatcher of the air carrier operating the aircraft. This form shall be signed by the pilot in command and by the authorized aircraft dispatcher only when both believe the flight may be made with safety. The authority to sign such clearance may be delegated for a particular flight by the authorized aircraft dispatcher, but the authority to dispatch cannot be delegated, and such dispatcher remains responsible for the dispatch and continued supervision of the flight.

[Amdt. 41-14, 12 F. R. 7995, as amended by Amdt. 41-3, 14 F. R. 2196]

§ 41.102 *Preparation of load manifest form.* A load manifest form showing the loading of the aircraft shall be prepared and signed for each flight by qualified personnel of the air carrier charged with the duty of supervising the loading of the aircraft and the preparation of the load manifest forms, or by qualified persons authorized by the air carrier. The aircraft when loaded shall not exceed the center of gravity limits or maximum allowable weight limits set forth in the aircraft certificate for the particular aircraft.

[Amdt. 41-14, 12 F R. 7995]

§ 41.103 *Traffic conditions.* Immediately prior to departure it is the responsibility of the dispatcher, dispatching an instrument flight outside of an airway traffic control area, to ascertain from the best available information what other flights affecting the proposed flight are in progress over the route and to report this information to the pilot in command.

[Amdt. 41-0, 10 F. R. 8528, as amended by Amdt. 41-3, 14 F. R. 2196]

§ 41.104 *Dispatcher emergency procedure.* In the event of inability to maintain two-way communication with the aircraft while it is in flight the dispatcher is responsible for notifying all other known traffic in the area of such failure, giving the last approved flight plan and the expected time of arrival at the destination.

§ 41.105 *Redispatch from alternate airports.* Aircraft may be redispatched from any alternate airport. In the case of an off-route alternate, the return to the authorized route must be made in accordance with conditions specified by the Administrator.

Flight Preparation and Take-Off Rules

§ 41.108 *Tests and checks.* Before departure the pilot in command is responsible for the testing or checking of each item in the check list approved by the Administrator, at the time and to the extent specified.

[Amdt. 41-0, 10 F. R. 8528, as amended by Amdt. 41-3, 14 F. R. 2196]

§ 41.109 *View of traffic.* The pilot shall maneuver the aircraft to a position from which incoming and outgoing aircraft can be observed until immediately prior to take-off.

Flight Course and En Route Rules

§ 41.110 *Continuance of flight, short distance operation.* No flight shall be continued toward any point to which it is cleared unless the weather conditions at alternate airports specified in the clearance remain at or above the minimums specified for each such airport when used as an alternate.

§ 41.111 *Change in clearance en route.* The clearance may be amended en route by the substitution of another alternate airport within the fuel range of the aircraft, as outlined in § 41.98 (b), where weather conditions are at or above the minimums for such airport when used as an alternate. If a change in clearance is made while an aircraft is in flight, the two-way conversation shall be entered in the ground station radio log. After clearance for contact flight no aircraft shall be recleared en route for instrument flight, unless all instruments and items of equipment required by § 41.25 for the type of operation are in serviceable condition.

§ 41.112 *Deviation from route.* No aircraft may deviate from the route over which it is dispatched except when circumstances render such deviation necessary as a safety measure. Any deviation from the route must be explained by the pilot in a written report dispatched to the Administrator within 7 days after return to his base.

§ 41.113 *Reporting unusual conditions.* When an icing or other unusual meteorological condition is encountered in flight the pilot shall notify his company radio ground station as soon as practicable and such information shall be relayed to all flights which may be affected.

§ 41.114 *Flight altitude rules*—(a) *Day contact operation.* Except during take-offs and landings no aircraft shall be flown at an altitude less than 500 feet above the ground or water, or within 500 feet of any mountain, hill, or other obstruction to flight, except in such cases as may be specifically approved.

(b) *Night and instrument operation.* Except during take-offs and landings or when operating in accordance with specific procedures for definite localities approved by the Administrator, no aircraft shall be flown at an altitude of less than 1,000 feet above the highest obstacle located within a horizontal distance of 5 miles from the center of the course intended to be flown.

§ 41.115 *Communication failure.* In the event of inability to maintain two-way radio communication, the pilot in command shall observe one of the following procedures in the order listed:

(a) Proceed according to current flight plan, maintaining the minimum instrument altitude or the last acknowledged assigned altitude, whichever is higher, to the airport of intended landing and commence descent at approach time last authorized or, if not received and acknowledged, at the estimated time of arrival specified in the flight plan; or

(b) If weather conditions permit, proceed in accordance with contact flight rules; or

(c) Land as soon as practicable.

Instrument Approach and Landing Rules

§ 41.117 *Altitude on initial approach.* When making an initial approach to a radio station on instruments or on top of overcast, an aircraft shall not be operated below the initial approach altitude specified for such station until arrival over the station has been definitely established, except where a marker facility is available and a procedure for a straight-in approach is authorized.

§ 41.118 *Letting-down-through procedure.* When instrument operation is authorized the standard instrument approach procedure, or the one authorized by the control tower if more than one procedure is specified for the airport, must be used for letting-down-through. The procedures and minimum altitudes of flight specified shall be strictly observed.

§ 41.119 *Approach and landing limitations.* No instrument approach procedure shall be executed or landing made at an airport when the latest U. S. Weather Bureau weather report for that airport indicates the ceiling or visibility to be less than that prescribed by the Administrator for landing at such airport.

[Amdt. 41-4, 12 F. R. 1479]

MISCELLANEOUS OPERATIONS RULES

§ 41.120 *Operations manual.* (a) The air carrier shall prepare and maintain a manual for the use and guidance of operations personnel which contains full information necessary to guide flight and ground personnel in the conduct of flight operations and to inform such personnel regarding their duties and responsibilities. It must be in a form approved by the Administrator and furnished to all persons designated by the Administrator or Board. All copies in the hands of company personnel must be kept up to date.

(b) Any changes issued by the Administrator shall be promptly incorporated in the manual. Other changes not inconsistent with any Federal regulation, the air carrier operating certificate, or safe operating practice may be made without the prior approval of the Administrator.

§ 41.120-1 *Copies of operations manual (CAA rules which apply to § 41.120).* A copy of the operations manual shall be delivered to the Director, Flight Operations Service, A-280, Civil Aeronautics Administration, Department of Commerce, Washington 25, D. C., and to the Chief, Scheduled Air Carrier Division, of the region in which headquarters of the air carrier is located. The latter person will inform air carriers of the need for any additional copies and to whom they shall be directed.

[13 F. R. 4251. Correction noted at 14 F. R. 37]

§ 41.121 *Admission to pilot compartment.* (a) No person except a member of the operating crew or an air carrier inspector of the Administrator may be admitted to the pilot compartment during flight unless his admission is approved by the pilot in command after he has identified himself as one of the following:

(1) An employee of the Federal Government, of an air carrier, or other aeronautical enterprise whose duties are such that his presence in the compartment is necessary or advantageous to the conduct of safe air carrier operations or the improvement of the safety of such operations;

NOTE: Federal employees who deal responsibly with matters relating to air carrier safety and such air carrier employees as pilots, dispatchers, meteorologists, communication operators, and mechanics whose efficiency would be increased by familiarity with flight conditions in the pilot compartment may be considered eligible for admission to the pilot compartment under this requirement. Employees of traffic, sales, and other air carrier departments not directly related to flight operations cannot be considered eligible unless authorized under § 41.121 (a) (2).

(2) A person whose presence in such compartment has been specifically authorized by the management of the air carrier operating the aircraft and by the Administrator.

(b) No person may occupy a seat in the pilot compartment or the companionway thereto unless such seat is securely attached to the structure of the aircraft and is provided with a safety belt which shall be kept fastened by the occupant throughout his occupancy of such seat.

(c) Unless a seat is also available for his use in the passenger compartment, no person may be admitted to the pilot compartment during flight except:

(1) Air carrier inspectors engaged in checking flight operations; and

(2) Certificated airmen of the air carrier and certificated airmen of another air carrier who have been authorized by the air carrier concerned and the Administrator to make specific trips over the route.

(d) An air carrier inspector of the Administrator must be admitted to the pilot compartment of an air carrier aircraft at any time while performing his official duty.

[Amdt. 41-0, 10 F. R. 8528, as amended by Amdt. 41-3, 14 F. R. 2196]

§ 41.122 *Manipulation of controls.* No person other than a qualified pilot of the air carrier may manipulate the flight controls of an air carrier aircraft while in scheduled flight, except that at the discretion of the pilot in command such restriction will not apply to other pilots as follows:

(a) Authorized air carrier inspectors of the Administrator, or

(b) Properly qualified pilot personnel of another air carrier, if the pilot in command is at one set of controls.

[Amdt. 41-0, 10 F. R. 8523, as amended by Amdt. 41-3, 14 F. R. 2196]

§ 41.123 *Smoking rules.* No smoking will be permitted in an aircraft:

(a) While on the ground or water,

(b) During take-offs and landings,

(c) In the berths of sleeper planes, or

(d) Elsewhere, unless suitable ash containers are provided.

§ 41.124 *Passenger information signs.* Aircraft shall be equipped with the following signs so located as to be plainly visible to passengers:

(a) "No smoking" signs located in the cabin and in individual berths,

(b) "Fasten seat belt" signs located in cabin,

(c) "Use oxygen equipment" signs located in the cabin of aircraft not having pressurized cabins when operated at altitudes in excess of 12,000 feet above sea level for any period of time, unless a competent cabin attendant is provided to care for passengers.

§ 41.125 *Marking door handles.* The latched and unlatched positions of door handles shall be plainly marked.

§ 41.126 *Marking emergency exits.* Emergency exits shall be clearly marked as such with luminous paint in letters not less than three-fourths of an inch high, such markings to be located either on or immediately adjacent to the pertinent exits and readily visible to passengers. The location and method of operation of the handles shall be marked with luminous paint.

§ 41.127 *Use of emergency equipment.* The emergency equipment required by § 41.23 must be periodically inspected and tested in accordance with specifications issued by the Administrator. The crew of aircraft used in overwater flights shall be drilled periodically in "abandon ship" procedures. Passengers shall be acquainted with the location of emergency exits, with emergency equipment provided for individual use, and with the procedure to be followed in the case of an emergency landing on the water.

§ 41.128 *Route operation proving flights.* Before passengers are carried on any new route or any extension of over 100 miles of a route previously authorized, the air carrier shall demonstrate ability to conduct a safe operation by making such flights over the route as the Administrator may require in the interest of safety.

§ 41.128-1 *Route proving flights (CAA rules which apply to § 41.128).* See § 40.102-1 of this subchapter. In paragraph (c), entitled "Application," sentence 1, substitute "30" for "15."

[13 F. R. 3460. Correction noted at 14 F. R. 37]

§ 41.129 *Aircraft proving tests.* (a) A new type of air carrier aircraft shall have at least 100 hours of proving tests under the supervision of an authorized representative of the Administrator before authority for carrying passengers is issued. At least 50 hours of such tests shall be flown over authorized routes and shall include at least 10 hours of night operation.

(b) In a case of major changes on aircraft previously proved, or the use of the same aircraft on a substantially different operation, 50 hours of tests similar to those outlined in the preceding paragraph shall be required, of which at least 25 hours shall be flown over authorized routes.

(c) During the tests specified in paragraphs (a) and (b) of this section no person shall be carried other than those essential to the tests. Mail, express, and cargo may be carried at the discretion of the Administrator.

[Amdt. 41-0, 10 F. R. 8528, as amended by Amdt. 41-3, 14 F. R. 2196]

§ 41.129-1 *Aircraft proving tests (CAA rules which apply to § 41.129).* See § 61.322-1 of this subchapter. In paragraph (b), entitled "Application", sentence 1, substitute "30" for "15".

[13 F. R. 3460. Correction noted at 14 F. R. 37]

§ 41.130 *Reports.* Each air carrier shall furnish the Administrator the following reports:

(a) A monthly operations report shall be submitted on and in accordance with the form supplied or approved by the Administrator for the purpose not later than the 20th day of the next succeeding month.

(b) A mechanical interruption report shall be submitted on the form supplied for the purpose not later than 10 days after the return of the aircraft to its operating base. Any partial or complete instrument or equipment mechanical failure which occurs during flight shall be reported. The records of such mechanical failure must be made available to any authorized representative of the Administrator or Board on request.

§ 41.130-1 *Mechanical hazard and difficulty reports (CAA rules which apply to § 41.130).* See § 61.341-1 of this subchapter.

[13 F. R. 5808, 5858. Correction noted at 14 F. R. 37]

§ 41.131 *Irregularity report.* All airmen, including flight and ground personnel, shall immediately report to the operations manager any irregularity or hazard which in their opinion makes for unsafe operation. If such report is found to be justified, notice of the irregularity or hazard must be submitted to the Administrator at once.

§ 41.131-1 *Mechanical hazard and difficulty reports (CAA rules which apply to § 41.131).* See § 61.341-1 of this subchapter.

[13 F. R. 5808, 5858. Correction noted at 14 F. R. 37]

§ 41.132 *Communication priority.* Where a communications channel serves point-to-point contacts in addition to ground-to-plane, priority shall be given to plane-to-ground and ground-to-plane communications.

§ 41.133 *Flight records.* The air carrier shall maintain and make available to any authorized representative of the Administrator or Board, for not less than 1 year from the date of flight, the records pertaining to any flight which was interrupted because of weather conditions and failed to land at the point to which it was originally cleared. Such records shall include the flight plan, flight log, clearance, and any other data necessary to complete the record of the operation.

DEFINITIONS

§ 41.137 *Definitions*—(a) *Route.* A route is a path through the navigable airspace identified by an area on the surface of the earth, the boundaries of which are designated or approved by the Administrator.

(b) *Short distance operation.* A short distance operation is one which involves intermediate stops of sufficient frequency to permit the dispatch from each such stop to be based on spot weather reports or a combination of spot weather reports and forecasts.

(c) *Long distance operation.* A long distance operation is one in which the time interval between stops is of sufficient duration to require that the dispatch be based entirely on forecasts of weather expected at the intended destination and alternates.

(d) *Regular airport.* A regular airport is an airport used as a regular stop on a route.

(e) *Provisional airport.* A provisional airport is an airport approved for the purpose of providing adequate service to a community when the regular airport serving that community is not available.

(f) *Alternate airport.* An alternate airport is one listed in the clearance as a point to which a flight may be directed if, subsequent to departure, a landing at the point to which the flight is cleared becomes undesirable.

(g) *Refueling and holding airport.* A refueling and holding airport is an airport approved as a point to which flights may be cleared for refueling.

(h) *Check pilot.* A check pilot is a pilot authorized by the Administrator to check pilots of the air carrier for familiarity with route procedures and for piloting technique.

(i) *Flight crew member.* Flight crew member means a pilot, flight radio operator, flight engineer, or flight navigator assigned to duty on the aircraft during flight time.

(j) *Crew member.* Crew member means any individual assigned by an air carrier for the performance of duty on the aircraft other than as flight crew member during flight time.

(k) *Contact operation.* A contact operation is an operation conducted under contact flight rules as prescribed in Part 60 of this subchapter.

(l) *Instrument operation.* An instrument operation is an operation conducted under instrument flight rules as prescribed in Part 60 of this subchapter.

(m) *Point-of-no-return.* The term "point-of-no-return" means that point at which the aircraft no longer has sufficient fuel, under existing conditions, to return to the point of departure or any alternate for that point.

(n) *Pilot compartment.* The term "pilot compartment" means that part of the aircraft designed for the use of the flight crew.

(o) *Ceiling.* The term "ceiling", as used in this part, means the height of the base of the lowest cloud layer reported as "broken clouds" or "overcast."

(p) *Broken clouds.* The term "broken clouds" means a condition where more than 50 but less than 90 percent of the sky is covered by clouds.

(q) *Route segment.* A route segment is a portion of a route, the boundaries of which are identified by:

(1) A continental or insular geographic location;

(2) A point at which some specialized aid to air navigation is located; or

(3) A point at which a definite radio fix is located.

(r) *Category.* Category shall indicate a classification of aircraft such as airplane, helicopter, glider, etc.

(s) *Class.* Class shall indicate a difference in basic design of aircraft within a category, such as single-engine land, multiengine sea, etc.

(t) *Copilot.* Copilot shall mean a pilot serving in any piloting capacity other than as pilot in command on aircraft requiring two pilots for normal operations, but excluding a pilot who is on board the aircraft for the sole purpose of receiving dual instruction.

(u) *Flight time.* Flight time shall mean the total time from the moment the aircraft first moves under its own power for the purpose of flight until the moment it comes to rest at the end of the flight (block to block).

(v) *Pilot in command.* Pilot in command shall mean the pilot responsible for the operation and safety of the aircraft during the time defined as flight time.

(w) *Type.* Type shall mean all aircraft of the same basic design including all modifications thereto except those modifications which result in a change in handling or flight characteristics.

[Amdt. 41-0, 10 F. R. 8528, as amended by Amdt. 41-1, 13 F. R. 5909, and Amdt. 41-3, 14 F. R. 2196]

PART 42—IRREGULAR AIR CARRIER AND OFF-ROUTE RULES

AUTHORITY: §§ 42.0 to 42.96 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 601, 604, 52 Stat. 1007, 1010; 49 U. S. C. 551, 554; Pub. Law 872, 80th Cong.

NOTE: Special Regulation Serial No. SR-325, effective August 27, 1948, 13 F. R. 5147, provides as follows:

Any air carrier authorized by the Board, pursuant to Title IV of the Civil Aeronautics Act of 1938, as amended, to engage in scheduled air transportation of cargo may conduct such transportation under the air carrier certification and operation rules prescribed in Part 42 of this subchapter.

This regulation shall supersede Special Civil Air Regulations Serial Nos. SR-317 and SR-317-A and shall terminate August 1, 1949, unless sooner terminated or rescinded by the Board.

SOURCE: §§ 42.0 to 42.96 appear at 14 F. R. 1427.

§ 42.0 *Applicability of this part.* (a) The provisions of this part shall apply to irregular air carriers operating in interstate, overseas, or foreign air transportation, to Alaskan air carriers when authorized by the Administrator under the provisions of § 41.1 (a) of this chapter, and to air carriers holding scheduled air carrier operating certificates when making charter trips or when performing other special services.

(b) An air carrier holding a scheduled air carrier operating certificate may elect to conduct charter flights or other special services between points which it is authorized to serve under the terms of such certificate, under the provisions of Part 41, or 40 and 61, of this chapter, as the case may be, and the scheduled air carrier operating certificate: *Provided,* That the certificate is amended to authorize such operation: *And provided further,* That charter or special services to other points shall be conducted under the provisions of this part, except that it shall not be necessary for the carrier to obtain an irregular air carrier operating certificate if its scheduled air carrier operating certificate is appropriately amended.

§ 42.1 *Definitions.* (a) As used in this part the words listed below shall be defined as follows:

(1) *Accelerate-stop distance.* Accelerate-stop distance is the distance required to reach the critical point of take-off and, assuming failure of the critical engine at that point, to bring the airplane to a stop using approved braking means. (See the airworthiness requirements under which the airplane was type certificated for the manner in which such distance is determined.)

(2) *Air carrier.* Air carrier means any citizen of the United States who undertakes directly the carriage by aircraft of persons or property as a common carrier for compensation or hire, whether such carriage is wholly by aircraft or partly by aircraft and partly by other forms of transportation between any of the following places: A place in any State of the United States, or the District of Columbia, and a place in any other State of the United States, or the District of Columbia; places in the same State of the United States through the airspace over any place outside thereof; places in the same Territory or possession of the United States, or the District of Columbia; a place in any State of the United States, or the District of Columbia, and any place in a Territory or possession of the United States, and a place in any other Territory or possession of the United States; a place in the United States and any place outside thereof; or the carriage of mail by aircraft.

(3) *Alaskan air carrier.* Alaskan air carrier includes any air carrier subject to the provisions of Part 292[1] of this chapter as heretofore or hereafter amended.

[1] Part 292 currently provides that Alaskan air carriers shall include certificated and noncertificated air carriers engaging solely in air transportation within the Territory of Alaska.

(4) *Alternate airport.* An alternate airport is one listed in the flight plan as a point to which a flight may be directed if, subsequent to departure, a landing at the point of intended destination becomes inadvisable.

(5) *Approach or take-off area.* The approach or take-off area shall be an area symmetrical about a line coinciding with and prolonging the center line of the runway, or the most probable landing or take-off path for instrument approaches where there is a multiplicity of parallel runways or a large hard-surfaced area continuously available for landing or take-off. This area shall be assumed to extend longitudinally in a straight line from the intersection of the obstruction clearance line with the runway to the most remote obstacle touched by the obstruction clearance line and in no case less than 1,500 feet. Thence, it shall be assumed to continue in a path consistent with the instrument approach or take-off procedures for the runway in question or, where such procedures are not specified, consistent with turns of at least 4,000 feet in radius. It shall be further assumed to extend laterally at the point of intersection of the obstruction clearance line with the runway 200 feet on each side of such center line. This distance shall increase uniformly to 500 feet on each side of such center line at a longitudinal distance of 1,500 feet from such point of intersection. Thereafter, this distance shall be assumed to be 500 feet on each side of such center line.

(6) *Approved.* Approved, when used either alone or as modifying other words such as "means," "method," "action," etc., shall mean approved by the Administrator.

(7) *Check pilot.* Check pilot is a pilot authorized by the Administrator to check pilots of the air carrier for such items as familiarity with en route procedures and piloting technique.

(8) *Crew member.* Crew member means any individual assigned for the performance of duty on the aircraft other than as a flight crew member.

(9) *Critical engine.* The critical engine is the engine the failure of which gives the most adverse effect on the performance characteristics of the aircraft. (See the airworthiness requirements under which the airplane was type certificated for the manner in which such engine is determined.)

(10) *Critical-engine-failure speed.* The critical-engine-failure speed is a true indicated air speed, selected by the aircraft manufacturer, at which the take-off may be safely continued even though the critical engine becomes suddenly inoperative. (See the airworthiness requirements under which the airplane was type certificated for the manner in which such speed is determined.)

(11) *Critical point of take-off.* The critical point of take-off is that point beyond which the aircraft cannot be brought to a safe stop in the event of failure of the critical engine. (See the airworthiness requirements under which the airplane was type certificated for the manner in which such point is determined.)

(12) *Effective length of runway.* The effective length of runway is the distance from the point where the obstruction clearance line intersects the runway to the far end thereof.

(13) *Flight crew member.* Flight crew member means a pilot, flight radio operator, flight engineer, or flight navigator assigned to flight duty on the aircraft.

(14) *Flight time.* Flight time shall mean the total time from the moment the aircraft first moves under its own power for the purpose of flight until the moment it comes to rest at the end of the flight.

(15) *IFR.* The symbol used to designate instrument flight rules.

(16) *Irregular air carrier.* Irregular air carrier includes any air carrier subject to the provisions of Part 291 [2] of this chapter as heretofore or hereafter amended.

(17) *Large aircraft.* Aircraft of 12,500 pounds or more maximum certificated take-off weight shall be considered large aircraft.

(18) *Maximum certificated take-off weight.* Maximum certificated take-off weight shall mean the maximum take-off weight authorized by the terms of the aircraft airworthiness certificate.[3]

(19) *Minimum control speed.* The minimum control speed is the minimum speed at which the airplane can be maintained in straight flight after an engine suddenly becomes inoperative. (See the airworthiness requirements under which the airplane was type certificated for the manner in which such speed is determined.)

(20) *Night.* Night is the time between the ending of evening twilight and the beginning of morning twilight as published in the Nautical Almanac converted to local time for the locality concerned.[4]

(21) *Obstruction clearance line.* The obstruction clearance line is a line drawn tangent to or clearing all obstructions showing in a profile of the approach or take-off area which has a slope to the horizontal of 1/20.

(22) *Passenger-carrying aircraft.* An aircraft carrying any individual other than a flight crew or crew member, company employee, or an authorized Government representative shall be considered a passenger-carrying aircraft.

(23) *Pilot compartment.* Pilot compartment means that part of the aircraft designed for the use of the flight crew.

(24) *Pilot in command.* Pilot in command shall mean the pilot responsible for the operation and safety of the aircraft during the time defined as flight time.

(25) *Point-of-no-return.* Point-of-no-return means the point beyond which the aircraft no longer has sufficient fuel, under existing conditions, to return to the point of departure or any alternate for that point.

(26) *Power-off stall speed.* The power-off stall speed is the minimum steady flight speed at which the airplane with engines idling is controllable in the landing configuration. (See the airworthiness requirements under which the airplane was type certificated for the manner in which such speed is determined.)

(27) *Rating.* Rating is an authorization issued with a certificate, and forming a part thereof, stating special conditions, privileges, or limitations pertaining to such certificate.

(28) *Runway.* A runway is a hard-surfaced area normally used for the landing or take-off of airplanes. An unpaved area at the end of a paved area may be considered as part of a runway if it is smooth and firm enough to permit an airplane to traverse it safely.

(29) *Second pilot.* Second pilot shall include any pilot other than the pilot in command assigned as a member of the flight crew.

(30) *Small aircraft.* Aircraft of less than 12,500 pounds maximum certificated take-off weight shall be considered small aircraft.

(31) *Transport category aircraft.* Transport category aircraft are aircraft which have been certificated in accordance with the requirements of Part 4b of this chapter, or under the transport category performance requirements of Part 4a of this chapter.

(32) *Type.* Type shall mean all aircraft of the same basic design including all modifications thereto except those modifications which result in a change in handling or flight characteristics.

(33) *VFR.* The symbol used to designate visual flight rules.

(34) V_{s_0}. V_{s_0} means the power-off, true-indicated stalling speed of an aircraft. (See the airworthiness requirements under which the airplane was type certificated for the manner in which V_{s_0} is determined.)

CERTIFICATE RULES

§ 42.5 *Certificate issuance.* An air carrier operating certificate describing the operations authorized and prescribing such operating specifications and limitations as may be reasonably required in the interest of safety shall be issued

[2] Part 291 currently provides that the term "irregular air carrier" means any air carrier which (1) directly engages in air transportation, (2) does not hold a certificate of public convenience and necessity under section 401 of the Civil Aeronautics Act of 1938, as amended, and (3) does not operate or hold out to the public, expressly or by course of conduct, that it operates one or more aircraft between designated points, or within a designated point, regularly or with a reasonable degree of regularity, upon which aircraft it accepts for transportation, for compensation or hire, such members of the public as apply therefor or such property as the public offers. No air carrier shall be deemed to be an irregular air carrier unless the air transportation services offered and performed by it are of such infrequency as to preclude an implication of a uniform pattern or normal consistency of operation between, or within, such designated points.

[3] Note that the aircraft airworthiness certificate incorporates as a part thereof an airplane operating record or an airplane flight manual which contains the pertinent limitation.

[4] The Nautical Almanac containing the ending of evening twilight and the beginning of morning twilight tables may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Information is also available concerning such tables in the offices of the Civil Aeronautics Administration or the United States Weather Bureau.

by the Administrator to a properly qualified citizen of the United States who is capable of conducting the proposed operations in accordance with the applicable requirements hereinafter specified. Application for a certificate, or application for amendment thereof, shall be made in a manner and contain information prescribed by the Administrator. No person subject to the provisions of this part shall operate in air transportation without, or in violation of the terms of, an air carrier operating certificate.

(a) *Exceptions.* Whenever upon investigation the Administrator finds that the general standards of safety required for air carrier operations require or permit a deviation from any specific requirement of this part, he may issue an air carrier operating certificate or amendment providing for such deviation. The Administrator shall promptly notify the Board of any deviation included in the air carrier operating certificate and the reasons therefor.

§ 42.6 *Duration.* An air carrier operating certificate shall continue in effect unless it is surrendered, suspended, or revoked, or a termination date is set by the Board, after which it shall be returned to the Administrator.

§ 42.7 *Display.* The air carrier operating certificate shall be kept available at the carrier's principal operations office for inspection by any authorized representative of the Administrator or Board.

§ 42.8 *Inspection.* Any authorized representative of the Administrator or the Board shall be permitted at any time and place to make inspections or examinations to determine the air carrier's compliance with the Civil Air Regulations.

§ 42.9 *Operations base, maintenance base, and/or office.* On or before July 1, 1949, each irregular air carrier shall give written notice to the Administrator of his principal business office, his principal operations base, and principal maintenance base. Thereafter, prior to any change in any such office or base, he shall give written notice to the Administrator.

AIRCRAFT REQUIREMENTS

§ 42.11 *Aircraft required.* An air carrier shall own or have the exclusive use of at least one aircraft. All aircraft used in the carriage of persons or property for compensation or hire shall be certificated in accordance with the standard airworthiness requirements. No air carrier shall operate a large aircraft for the carriage of goods or persons for compensation or hire unless the Administrator has found such aircraft safe for the service to be offered and has listed it in the air carrier operating certificate.

§ 42.12 *Fire prevention requirements.* Aircraft powered by an engine or engines rated at more than 600 h. p. each for maximum continuous operation shall, when used in passenger service, comply with the applicable fire prevention requirements of Part 4b of this chapter: *Provided,* That in those instances where the Administrator, prior to the effective date of this part, has authorized an air carrier to operate aircraft without full compliance with such requirements, such aircraft may be operated in accordance with such authorization. For particular types of aircraft, where the Administrator finds that literal compliance with specific items of this requirement would not contribute materially to the objective sought, he may accept such measures of compliance as he finds will so contribute.

§ 42.13 *Engine rotation.* Multiengine aircraft having any engine rated at more than 480 h. p. for maximum continuous operation shall be so equipped that the crankshaft rotation of each such engine can be stopped promptly in flight.

§ 42.14 *Minimum performance requirements for all aircraft.* Except as otherwise provided in this part, no air carrier shall use any aircraft unless it meets such operating limitations as the Administrator determines will provide a safe relation between the performance of the aircraft and the airports to be used and the areas to be traversed.

§ 42.15 *Minimum performance requirements for large airplanes used in passenger operations.* No air carrier shall use large airplanes in passenger operations except as provided below:

(a) Transport category airplanes shall meet the operating limitations of §§ 42.70 through 42.78.

(b) Nontransport category airplanes shall either:

(1) Retain their present airworthiness certificate status and shall meet the operating limitations of §§ 42.80 through 42.83, or

(2) Qualify by showing compliance with either the performance requirements of §§ 4a.737-T through 4a.750-T of this chapter or the requirements contained in Part 4b of this chapter, and when so qualified shall meet the operating limitations of §§ 42.70 through 42.78 over the area to be traversed.

(c) Airplanes used after December 31, 1953, shall comply with all of the requirements of Part 4b of this chapter or the transport category requirements of Part 4a of this chapter and shall meet the requirements of §§ 42.70 through 42.78 over each route to be flown.

§ 42.16 *Aircraft limitations for IFR and land aircraft overwater operations.* When passengers are carried, no air carrier shall use any aircraft under IFR weather conditions or any land aircraft in overwater operations except as follows:

(a) *IFR operations.* Aircraft shall be multiengine and shall meet the appropriate en route operating limitations of § 42.74 or § 42.82.

(b) *Overwater operations.* Land aircraft shall be multiengine and shall meet the appropriate en route operating requirements of § 42.74 or § 42.82, unless the overwater operation consists only of take-offs and landings or the aircraft is flown at such an altitude that it can reach land in the event of power failure.

AIRCRAFT EQUIPMENT

§ 42.21 *Basic required instruments and equipment for aircraft.* The following instruments and equipment acceptable to the Administrator for the type of operations specified shall be installed and in serviceable condition in all aircraft:

(a) *VFR (day).* For day VFR flight the following is required:

(1) Air-speed indicator,

(2) Altimeter,

(3) Magnetic direction indicator,

(4) Tachometer for each engine,

(5) Oil pressure gauge for each engine using pressure system,

(6) Coolant temperature gauge for each liquid-cooled engine,

(7) Oil temperature gauge for each air-cooled engine,

(8) Manifold pressure gauge or equivalent when required for the proper operation of the engine,

(9) Fuel gauge indicating the quantity of fuel in each tank,

(10) Position indicator, if aircraft has retractable landing gear or flaps,

(11) Approved seats and safety belts adequate for all persons on board the aircraft,

(12) In passenger service, a minimum of two approved hand-type fire extinguishers, one of which is installed in the pilot compartment, the other accessible to the passengers and ground personnel, unless the aircraft is so designed that the fire extinguisher in the pilot compartment is directly available to passengers and ground personnel, in which case only one fire extinguisher is required; in cargo service, fire extinguisher or extinguishers adequate for the aircraft,

(13) Source of electrical energy sufficient to operate all radio and electrical equipment installed,

(14) One spare set of fuses or 3 spare fuses of each magnitude.

(b) *VFR (night).* For night VFR flight the following is required:

(1) Instruments and equipment specified in § 42.21 (a),

(2) Carburetor temperature gauge,

(3) Carburetor heating or de-icing equipment for each engine,

(4) Set of approved forward and rear position lights,

(5) At least one landing light,

(6) Approved landing flares as follows, if the aircraft is operated beyond a 3-mile radius from the center of the airport of take-off:

Maximum certificated take-off weight of aircraft:	*Flares*
Less than 3,500 lbs.	5 class-3 or 3 class-2.
3,500 lbs. to 5,000 lbs.	4 class-2.
More than 5,000 lbs.	2 class-1 or 3 class-2, and 1 class-1.

If desired, flare equipment specified for heavier aircraft may be used.

(7) Two-way radio communications system and navigational equipment appropriate to the ground facilities to be used,

(8) Generator of adequate capacity,

(9) One set of instrument lights.

(c) *IFR (day).* For day IFR flight the following is required:

(1) Instruments and equipment specified in § 42.21 (a),

(2) Two-way radio communications system and navigational equipment appropriate to the ground facilities to be used,

(3) Gyroscopic rate-of-turn indicator,
(4) Bank indicator,
(5) Rate-of-climb indicator,
(6) Artificial horizon indicator,
(7) Sensitive altimeter adjustable for changes in barometric pressure, in lieu of § 42.21 (a) (2),
(8) Clock with a sweep-second hand,
(9) One gyro direction indicator,
(10) Generator of adequate capacity,
(11) One outside air temperature gauge easily readable from the pilot's position,
(12) One carburetor temperature gauge or equivalent approved device,
(13) Power failure warning means or vacuum gauge on instrument panel connecting to lines leading to gyroscopic instruments,
(14) Carburetor heating or de-icing equipment for each engine,
(15) Heated pitot tube for each air-speed indicator.

(d) *IFR (night)*. For night IFR flight the following is required:
(1) Instruments and equipment specified in paragraphs (a), (b), and (c) of this section: *Provided*, That when any requirements under paragraphs (a), (b), or (c) of this section are identical, such requirements need not be duplicated.

§ 42.22 *Additional required instruments and equipment for large aircraft.* In addition to the basic instruments required by § 42.21, the following instruments and equipment for the type of operations specified shall be installed and in serviceable condition in large aircraft:

(a) *Day (VFR and IFR)*. For flight during the day the following is required:
(1) Additional air-speed indicator,
(2) Additional sensitive altimeter.
(3) Alternate source of energy to supply gyroscopic instruments which shall be capable of carrying the required load. Engine-driven pumps, when used, shall be on separate engines and, in lieu of one such source of energy, an auxiliary power unit may be used. The installation shall be such that the failure of one source of energy will not interfere with the proper functioning of the instrument by means of the other source.
(4) In passenger service, in addition to fire-detecting and fire-extinguishing equipment necessitated as a result of compliance with § 42.12, such additional hand-type fire extinguishers as the Administrator finds necessary for compliance with § 42.21 (a) (12).

(b) *Night (VFR and IFR)*. For flight during the night the following is required:
(1) Instruments and equipment specified in paragraph (a) of this section, and one additional landing light.

§ 42.23 *Radio communications system and navigational equipment for large aircraft.* In lieu of the radio communications system and navigational equipment specified in § 42.21 (b) (7) and (c) (2), the following shall be required in large aircraft for the type of operations specified:

(a) For day VFR operations over routes on which navigation can be accomplished by visual reference to landmarks, each aircraft shall be equipped with such radio equipment as is necessary to accomplish the following:
(1) Transmit to at least one appropriate ground station from any point on the route and transmit to airport traffic control towers, from a distance of not less than 25 miles,
(2) Receive communications at any point on the route,
(3) By either of two independent means, receive meteorological information at any point on the route and receive instructions from airport traffic control towers.

(b) For day VFR operations over routes on which navigation cannot be accomplished by visual reference to landmarks, for night VFR, or for IFR operations, each aircraft shall be equipped as specified in paragraphs (a) (1), (2), and (3) of this section, and in addition shall be equipped with at least one marker beacon receiver and with such radio equipment as is necessary to receive satisfactorily, by either of two independent means, radio navigational signals from any other radio aid to navigation intended to be used. For operations outside the United States each aircraft operated for long distances over water or uninhabited terrain shall be equipped with two independent means of transmitting to at least one appropriate ground station from any point on the route.

(c) If appropriate, one of the means provided for compliance with paragraph (a) (3) of this section may be employed for compliance with paragraphs (a) (2) of this section, and the means provided for compliance with the requirements of paragraph (b) of this section may be employed for compliance with paragraphs (a) (1) and (3) of this section.

§ 42.24 *First-aid and emergency equipment.* (a) Each aircraft shall be equipped with readily available first-aid and emergency evacuation equipment adequate for the type of operation and number of persons carried.

(b) Each aircraft operated over uninhabited terrain shall carry such emergency equipment as the Administrator finds necessary for the preservation of life for the particular operation.

(c) Except for take-offs, landings, or flights for short distances over water for which the Administrator finds that any of the equipment in subparagraphs (1), (2), or (3) of this paragraph is unnecessary, each aircraft operated over water shall be equipped with:
(1) Individual life preservers or flotation devices readily available for each person aboard the aircraft,
(2) Life rafts of sufficient capacity to contain all persons aboard the aircraft,
(3) A Very pistol or equivalent signal equipment,
(4) Portable emergency radio signalling device which is not dependent upon the aircraft power supply,
(5) Such additional emergency equipment as the Administrator finds necessary for the preservation of life for the particular operation involved.

§ 42.25 *Cockpit check list.* The air carrier shall provide for each type of aircraft a cockpit check list adapted to each operation in which the aircraft is to be utilized. The check list shall be installed in a readily accessible location in the cockpit of each aircraft and shall be used by the flight crew.

§ 42.26 *Oxygen.* Aircraft operated at an altitude exceeding 10,000 feet above sea level continuously for more than 30 minutes, or at an altitude exceeding 12,000 feet above sea level for any length of time, shall be equipped with effective oxygen apparatus and an adequate supply of oxygen available for the use of the operating crew. Such aircraft shall also be equipped with an adequate separate supply of oxygen available for the use of passengers when operated at an altitude exceeding 12,000 feet above sea level.

MAINTENANCE REQUIREMENTS

§ 42.30 *General.* No person shall operate an aircraft which is not in an airworthy condition. All inspections, repairs, alterations, and maintenance shall be performed in accordance with Part 18 of this chapter, and with the maintenance manual when required by § 42.32 (d).

§ 42.31 *Inspections and maintenance.* (a) Aircraft shall be given a preflight check to determine compliance with § 42.51 (e) and, in, addition, shall meet the following requirements:
(1) Large aircraft shall be maintained and inspected in accordance with a continuous maintenance and inspection system as provided for in the maintenance manual.
(2) Small aircraft shall either be maintained and inspected in accordance with subparagraph (1) of this paragraph or be given a periodic inspection at least every 100 hours of flight time and an annual inspection at least every 12 months. The annual inspection may be accepted as a periodic inspection.

(b) A record shall be carried in the aircraft at all times showing that the latest inspections required by paragraphs (a) (1) or (2) have been accomplished, except such record may be kept at the principal operations base when the aircraft is maintained and inspected as provided in paragraph (a) (1) of this section.

§ 42.32 *Additional maintenance requirements for large aircraft.* The following requirements are applicable to operations conducted in large aircraft:

(a) *Facilities.* Facilities for the proper inspection, maintenance, overhaul, and repair of the types of aircraft used shall be maintained by the air carrier, unless arrangements acceptable to the Administrator are made with other persons possessing such facilities.

(b) *Maintenance personnel.* A staff of qualified mechanics, inspectors, and appropriate supervisory personnel shall be employed by the air carrier and kept available for performing the functions specified in § 42.30, except where the air carrier has obtained the approval of the Administrator for the performance of such functions by some other person. The air carrier shall permit maintenance to be performed only by an individual competent therefor.

(c) *Reporting of mechanical irregularities occuring in operation.* Each air carrier shall prescribe in its operations manual a procedure for the submission of written reports by the members of the flight crew for all mechanical irregularities occurring during the operation of the aircraft. The members of the flight crew designated by the air carrier shall submit a written report in accordance with such system to the person responsible for the maintenance of the aircraft. This report shall be submitted at the end of each through flight or sooner if the seriousness of the irregularity so warrants. Such report or copy thereof indicating the action taken shall be retained in the aircraft for the information of the next flight crew.[6]

(d) *Maintenance manual.* (1) The air carrier shall prepare and maintain for the use and guidance of maintenance personnel a maintenance manual which contains full information pertaining to the maintenance, repair, and inspection of aircraft and equipment and clearly outlines the duties and the responsibilities of maintenance personnel. The form and content shall be acceptable to the Administrator. It shall contain a copy of the approved time limitations for inspection and overhauling of aircraft, aircraft engines, propellers, and appliances. Copies and revisions shall be furnished to all persons designated by the Administrator. All copies in the hands of company personnel shall be kept up to date.

(2) A copy of those portions pertaining to the aircraft shall be carried therein.

(3) Any changes prescribed by the Administrator in the interest of safety shall be promptly incorporated in the manual. Other changes not inconsistent with any Federal regulation, the air carrier operating certificate, or safe operating practices may be made without prior approval of the Administrator.

(4) No maintenance, repair, or inspection of aircraft or equipment shall be made by the air carrier contrary to the provisions of the maintenance manual.

FLIGHT CREW REQUIREMENTS

§ 42.40 *Airman requirements.* No air carrier shall utilize an individual as an airman unless he has met the appropriate requirements of this subchapter.

§ 42.41 *Composition of flight crew.* (a) No air carrier shall operate an aircraft with less than the minimum flight crew required for the particular operation and the type of aircraft, as determined by the Administrator in accordance with the standards hereinafter prescribed, and specified in the air carrier operations manual for the area in which operations are authorized.

(b) Where the provisions of this part require the performance of two or more functions for which an airman certificate is necessary, such requirement shall not be satisfied by the performance of multiple functions at the same time by any airman.

(c) *Second pilot.* A second pilot shall be required on large aircraft, or on other aircraft when passengers are carried on operations under IFR, or when the Administrator finds that a second pilot is otherwise required in the interest of safety.

[6] See § 42.96 for the requirements for reporting aircraft or component malfunctioning and defects.

(d) *Flight radio operator.* An airman holding a flight radio operator certificate shall be required for flight over any area over which the Administrator has determined that radiotelegraphy is necessary for communication with ground stations during flight.

(e) *Flight engineer.* An airman holding a flight engineer certificate shall be required on all aircraft of more than 80,000 lbs. maximum certificated take-off weight, and on all other aircraft certificated for more than 30,000 lbs. maximum certificated take-off weight where the Administrator finds that the design of the aircraft used or the type of operation is such as to require a flight engineer for the safe operation of the aircraft, or on other aircraft where required by the aircraft airworthiness certificate.

(f) *Flight navigator.* An airman holding a flight navigator certificate shall be required for flight over any area where the Administrator has determined that celestial navigation is necessary.

§ 42.42 *Pilot qualification for small aircraft*—(a) *Pilot in command.* Any pilot serving as pilot in command on small aircraft shall hold a valid commercial pilot certificate with an appropriate rating for the aircraft on which he is to serve, and for:

(1) *Day flight VFR.* He shall have had at least 50 hours of cross-country flight time as a pilot;

(2) *Night flight VFR.* He shall have had a total of at least 500 hours of flight time as a pilot, including 100 hours of cross-country flight time of which 25 hours shall have been at night;

(3) *IFR flight.* He must possess a currently effective instrument rating and have had a total of at least 500 hours of flight time as a pilot including 100 hours of cross-country flight.

(b) *Second pilot.* Any pilot serving as second pilot on small aircraft shall hold for:

(1) *VFR flight.* A valid commercial pilot certificate with the appropriate ratings;

(2) *IFR flights.* A currently effective instrument rating.

§ 42.43 *Pilot qualification for large aircraft*—(a) *Pilot in command.* Any pilot serving as pilot in command on large aircraft shall meet the following requirements:

(1) After December 31, 1949, he shall possess a valid airline transport pilot rating with an appropriate rating for the aircraft on which he is to serve;

(2) Prior to and including December 31, 1949, he shall either meet the above or;

(i) Possess a valid commercial pilot certificate with an appropriate rating for the aircraft on which he is to serve;

(ii) Possess a currently effective instrument rating;

(iii) Have logged at least 1,200 hours of flight time of which 500 hours shall have been cross-country;

(iv) Have logged at least 100 hours of night flight of which 50 hours shall have been cross-country.

(b) *Second pilot.* Any pilot serving as second pilot in large aircraft shall:

(1) Possess a valid commercial pilot certificate with an appropriate rating for the aircraft on which he is to serve;

(2) Possess a currently effective instrument rating.

(c) *Three-pilot crew.* In a crew of three or more pilots at least two pilots shall meet the requirements of paragraph (a) of this section.

§ 42.44 *Recent flight experience requirements for flight crew members.* No air carrier shall utilize an airman, nor shall any individual serve as an airman, unless he meets the appropriate experience requirements specified below:

(a) *Pilots.* (1) Within the preceding 90 days a pilot shall have made at least 3 take-offs and landings in an aircraft of the same type on which he is to serve. For night flight one of the take-offs and landings required above shall have been made at night.

(2) Within the preceding 6 months a pilot in large aircraft shall have successfully accomplished an equipment check on aircraft of the type on which he is to serve. Such equipment check shall be given by an authorized representative of the Administrator or a check pilot designated by the Administrator.

(3) Within the preceding 6 months the pilot in command on any large aircraft, or on any aircraft under IFR conditions, shall have successfully accomplished an instrument check demonstrating his ability to pilot and navigate by instruments, to accomplish a standard instrument approach using radio range facilities, and to accomplish an instrument approach in accordance with ILS, GCA, or D/F procedures when such facilities are to be used. This instrument check shall have been given by an authorized representative of the Administrator or a check pilot designated by the Administrator on an aircraft which the air carrier is authorized to use.

(b) *Flight radio operator.* No individual shall be assigned to nor perform duties as a flight radio operator unless within the preceding 12 months he has had at least four months of satisfactory experience as a radiotelegraph operator and at least 25 hours of experience in the operation of aircraft radio during flight, or until a person designated by the Administrator has checked the airman and has determined that he is (1) familiar with all radio information pertinent to the operations of the air carrier and (2) competent with respect to the operating procedures and radio equipment to be used.

(c) *Flight engineer.* No individual shall be assigned to nor perform the duties as a flight engineer unless within the preceding 12 months he has had at least 50 hours of experience as a flight engineer on the type of aircraft on which he is to serve, or until a person designated by the Administrator has checked the airman and determined that he is (1) familiar with all current information and operating procedures relating to the type of aircraft on which he is to serve and (2) competent with respect to the flight engineer's duties on such aircraft.

(d) *Flight navigator.* No individual shall be assigned to nor perform duties as a flight navigator unless within the preceding 12 months he has had at least

50 hours of experience as a flight navigator, or until a person designated by the Administrator has checked the airman and determined that he is (1) familiar with all current navigational information pertaining to the operations of the air carrier and (2) competent with respect to the operating procedures and navigational equipment to be used.

§ 42.45 *Proficiency of crew members serving on large aircraft.* The air carrier shall by means of a training program or otherwise insure that crew members are proficient in their duties and are kept currently informed of all techniques and new developments pertinent thereto. The program shall include instruction in emergency procedures and in crew coordination.

§ 42.46 *Logging flight time.* (a) A pilot in command may log his total flight time.

(b) A second pilot holding an airline transport pilot certificate and rating for the aircraft flown may log the total time during which he is on duty on the flight deck.

(c) A second pilot not holding an airline transport pilot certificate and rating for the aircraft flown may log 50% of the total flight time during which he is on duty on the flight deck.

(d) A pilot may log as instrument flight time only such time as he is actually manipulating the controls when the aircraft is being flown solely by reference to instruments.

§ 42.47 *Grace period for airman periodic checks.* Whenever this part requires an airman check at stated intervals, a grace period of 30 days shall be allowed: *Provided,* That the effective date of the check, if met within the grace period, shall be the same as if met on the day immediately preceding such grace period.

§ 42.48 *Flight time limitations for pilots on large aircraft.* The following limitations shall be applicable to pilots serving on large aircraft.

(a) *Individual pilot limitations.* (1) A pilot may be scheduled to fly 8 hours or less during any 24 consecutive hours without a rest period during such 8 hours.

(2) A pilot shall receive 24 hours of rest before being assigned further duty when he has flown in excess of 8 hours during any 24 consecutive hours. Time spent in deadhead transportation to or from duty assignment shall not be considered part of such rest period.

(3) A pilot shall be relieved from all duty for not less than 24 consecutive hours at least once during any 7 consecutive days.

(4) A pilot shall not fly as a crew member in air carrier service more than 100 hours during any 30 consecutive days.

(5) A pilot shall not fly as a crew member in air carrier service more than 1,000 hours in any one calendar year.

(6) A pilot shall not do other commercial flying if his total flying time for any specified period will exceed the limits of that period.

(b) *Aircraft having a crew of two pilots.* (1) A pilot shall not be scheduled to fly in excess of 8 hours during any 24-hour period unless he is given an intervening rest period at or before the termination of 8 scheduled hours of flight duty. Such rest period shall equal at least twice the number of hours flown since the last preceding rest period, and in no case shall such rest period be less than 8 hours. During such rest period the pilot shall be relieved of all duty with the air carrier.

(2) A pilot shall not be on duty for more than 16 hours during any 24 consecutive hours.

(c) *Aircraft having a crew of three pilots.* (1) A pilot shall not be scheduled for duty on the flight deck in excess of 8 hours in any 24-hour period.

(2) A pilot shall not be scheduled to be aloft for more than 12 hours in any 24-hour period.

(3) A pilot shall not be on duty for more than 18 hours in any 24-hour period.

(d) *Aircraft having a crew of four pilots.* (1) A pilot shall not be scheduled for duty on the flight deck in excess of 8 hours during any 24-hour period.

(2) A pilot shall not be scheduled to be aloft for more than 16 hours in any 24-hour period.

(3) A pilot shall not be on duty for more than 20 hours during any 24-hour period.

FLIGHT OPERATION RULES

§ 42.51 *Pilot responsibilities*—(a) *Pilot in command.* The pilot in command of the aircraft shall be designated by the air carrier.

(b) *Preflight action.* Prior to commencing a flight the pilot in command shall familiarize himself with the latest weather reports pertinent to the flight issued by the United States Weather Bureau or if unavailable, by the most reliable source, and with the information necessary for the safe operation of the aircraft en route and on the airports or other landing areas to be used, and determine that the flight can be completed with safety.

(c) *Charts and flight equipment.* The pilot in command shall have in his possession in the cockpit proper flight and navigational facility charts, including instrument approach procedures when instrument flight is authorized, and such other flight equipment as may be necessary to properly conduct the particular flight proposed.

(d) *Emergency decisions.* (1) When required in the interest of safety, a pilot may make any immediate decision and follow any course of action which in his judgment appears necessary, regardless of prescribed methods or requirements. He shall, where practicable, keep the proper control station fully informed regarding the progress of the flight.[6]

(2) In an emergency requiring either the dumping of fuel or a landing at a weight in excess of the authorized landing weight, a pilot may elect to follow whichever procedure he considers safer.

[6] See § 42.94 for the report to be filed by the pilot where the authority granted by this section is exercised.

(e) *Serviceability of equipment.* Prior to starting any flight, the pilot shall determine that the aircraft, all engines and propellers, appliances and required equipment, including all instruments, are in proper operating condition. If during the flight any such engine, propeller, appliance, or equipment malfunctions or becomes inoperative, the pilot in command shall determine whether the flight can be continued with safety. Unless he believes that flight can be continued safely, he shall hold or cancel it until satisfactory repairs or replacements are made.

(f) *Pilots at controls.* In the case of aircraft requiring two or more pilots, two pilots shall remain at the controls at all times while taking off, landing, and while the aircraft is en route except when the absence of one is necessary in connection with his regular duties or when he is replaced by a person authorized under the provisions of paragraph (g) of this section.

(g) *Admission to pilot compartment.* In aircraft having a separate pilot compartment, no person other than a crew member, a check pilot, an authorized representative of the Administrator or the Board in pursuance of official duty, or a person whose admission is approved by the pilot in command may be admitted to the pilot compartment. In the latter case, the pilot in command shall remain at the controls.

§ 42.52 *Fuel supply.* The following minimum fuel requirements shall be applicable as specified:

(a) *United States.* Within the continental limits of the United States the following requirements shall be met unless the Administrator finds, after considering the character of the terrain being traversed, the available airports, and the category of aircraft being operated, that the safe conduct of the flight normally requires a greater quantity of fuel.

(1) No flight in small aircraft under VFR shall be started unless the aircraft carries sufficient fuel and oil, considering the wind and other weather conditions forecast, to fly to the point of intended landing, and thereafter for a period of at least 30 minutes at normal cruising consumption.

(2) No flight in large aircraft under VFR shall be started unless, considering the factors enumerated in subparagraph (1) of this paragraph, the aircraft carries sufficient fuel and oil to fly to the point of intended landing, and thereafter for a period of at least 45 minutes at normal cruising consumption.

(3) No flight in large or small aircraft under IFR shall be started unless, considering the factors set forth in subparagraph (1) of this paragraph, sufficient fuel and oil are carried aboard the aircraft (i) to reach the point of intended landing, (ii) thereafter to fly to the alternate airport, and (iii) thereafter to fly for a period of 45 minutes at normal cruising consumption.

(b) *Outside the United States.* Outside the continental limits of the United States, the following requirements shall be met unless the Administrator finds, after considering the character of the terrain being traversed, the available airports, and the category and type of aircraft being operated, that the flight may be safely conducted with a lesser quantity of fuel.

(1) No flight shall be started unless, considering the wind and other weather conditions expected, the aircraft carries sufficient fuel and oil (i) to fly to the next point of landing specified in the flight plan, (ii) thereafter to fly to and land at the most distant alternate airport designated in the flight plan, and (iii) thereafter to fly for a period of at least 2 hours at normal cruising consumption.

(2) No flight shall be returned to the point of departure or to an alternate airport for that point unless the aircraft has sufficient fuel to return to such point and thereafter to fly for a period of at least 2 hours at normal cruising consumption.

(3) No flight shall be started to a destination for which there is no available alternate unless the aircraft carries sufficient fuel, considering wind and other weather conditions expected, to fly to that point and thereafter to fly for at least 3 hours at normal cruising consumption.

§ 42.53 *Minimum flight altitude rules.* Except during take-off and landing, the flight altitude rules prescribed in paragraphs (a) and (b) of this paragraph, in addition to the applicable provisions of § 60.17 of this chapter, shall govern air carrier operations: *Provided*, That other altitudes may be established by the Administrator for any area where he finds, after considering the character of the terrain being traversed, the quality and quantity of meteorological service, the navigational facilities available, and other flight conditions, that the safe conduct of flight permits or requires such other altitudes.

(a) *Day VFR operations.* No aircraft shall be flown at an altitude less than 500 feet above the surface or less than 1,000 feet from any mountain, hill, or other obstruction to flight.

(b) *Night VFR or IFR operations.* No aircraft shall be flown at an altitude less than 1,000 feet above the highest obstacle located within a horizontal distance of 5 miles from the center of the course intended to be flown or, in mountainous terrain designated by the Administrator, 2,000 feet above the highest obstacle located within a horizontal distance of 5 miles from the center of the course intended to be flown: *Provided*, That in VFR operations at night in such mountainous terrain aircraft may be flown over a lighted civil airway at a minimum altitude of 1,000 feet above such obstacle.

§ 42.54 *Flight into known icing conditions.* No aircraft shall be flown into known or probable heavy icing conditions. Aircraft may be flown into light or moderate icing conditions only if the aircraft is equipped with an approved means for de-icing the wings, propellers, and such other parts of the aircraft as are essential to safety.

§ 42.55 *Weather minimums.* No flight shall be started unless the take-off, en route operation, and landing at destination can be conducted in accordance with the weather requirements of Part 60 of this chapter,[7] but in no case less than the minimums specified below:

(a) For VFR take-off, en route operation, or landing, the weather minimums shall be a ceiling of 1,000 feet and visibility of 1 mile for day and 2 miles for night, unless otherwise authorized by an air traffic clearance obtained from air traffic control, and

(b) For IFR operations the weather minimums, including alternate airport requirements, shall be not less than those specified in the CAA Flight Information Manual, or as otherwise specified or authorized by the Administrator.

§ 42.56 *Instrument approach.* No instrument approach procedure shall be executed or landing made at an airport when the latest United States Weather Bureau report for that airport indicates the ceiling or visibility to be less than that prescribed by the Administrator for landing at such airport.

§ 42.57 *Airport lighting for night operations.* No air carrier shall use an airport for the take-off or landing of an aircraft at night unless such airport is adequately lighted.

§ 42.58 *Navigational aids for IFR flight.* IFR operations shall be conducted only over civil airways and at airports equipped with radio ranges or equivalent facilities, unless the Administrator has found that instrument navigation can be conducted by the use of radio direction finding equipment installed in the aircraft or by other specialized means and has approved or otherwise authorized such operation in the air carrier operating certificate.

§ 42.59 *Passenger use of emergency equipment.* The air carrier shall establish procedures for familiarizing passengers with the location and use of emergency equipment.

§ 42.60 *Operations manual for large aircraft.* (a) When operations are conducted in large aircraft the air carrier shall prepare and maintain for the use and guidance of operations personnel an operations manual which contains full information necessary to guide flight and ground personnel in the conduct of safe flight operations and to inform such personnel regarding their duties and responsibilities. The manual shall also contain a copy of the air carrier operating certificate. The form and content shall be acceptable to the Administrator. Copies and revisions shall be furnished to all persons designated by the Administrator. All copies in the hands of company personnel shall be kept up to date.

(b) A copy of the operations manual shall be kept at the principal operations base. Those portions of the manual pertinent to safe operation of the aircraft, including the copy of the air carrier operating certificate, shall be carried therein.

(c) Any changes prescribed by the Administrator in the interest of safety shall be promptly incorporated in the manual. Other changes not inconsistent with any Federal regulation, the air carrier operating certificate, or a safe operating practice may be made without the prior approval of the Administrator.

(d) No operation shall be conducted by the air carrier contrary to the safety provisions of the operations manual.

§ 42.61 *Flight plan for large aircraft.* No large aircraft shall be taken off unless a VFR or IFR flight plan containing the appropriate information required by Part 60 of this chapter is filed by the air carrier with the nearest CAA communications station or, when outside the United States, with the appropriate authority. In the event communications facilities are not readily available, such flight plan shall be filed as soon as practicable after becoming air-borne.

§ 42.62 *Flight manifest for large aircraft and passenger-carrying aircraft operating under IFR conditions.* For all large aircraft, or any aircraft carrying passengers under IFR conditions, a flight manifest form shall be prepared and signed for each flight by qualified personnel of the air carrier charged with the duty of supervising the loading of the aircraft and the preparation of the flight manifest form. The form and contents of this manifest shall be in accordance with the instructions contained in the air carrier's operations manual and shall include the names and addresses of the passengers carried, points of departure and destination, the weight of the cargo and passengers, and the distribution of such weight in the aircraft in accordance with the weight control system prescribed in the operations manual. The weight of the passengers may be determined in accordance with a weight control system prescribed by the Administrator. In the event passengers are picked up at points other than the principal operations base or discharged at points other than as shown on the latest manifest, the pilot shall, before starting the flight, cause a duplicate copy of the revised manifest to be mailed to such base, unless other requirements are set forth in the carrier's operations manual.[8]

OPERATING LIMITATIONS FOR LARGE PASSENGER-CARRYING AIRPLANES

§ 42.70 *Operating limitations for transport category airplanes.* (a) In operating any passenger-carrying transport category airplane the provisions of §§ 42.71 through 42.78 shall be complied with unless deviations therefrom are specifically authorized by the Administrator on the ground that the special circumstances of a particular case make a literal observance of the requirements unnecessary for safety.

(b) For transport category aircraft the data contained in the Airplane Flight Manual shall be applied in determining compliance with these provisions. Where conditions differ from those for which specific tests were made, compliance shall be determined by interpolation or by computation of the effects of changes in the specific variables where such interpolations or computations will give re-

[7] See the Flight Information Manual for specific en route, take-off, and landing minimums for particular routes and airports.

[8] See § 42.95 for record-keeping requirements for the flight manifest.

sults substantially equalling in accuracy the results of a direct test.

§ 42.71 *Weight limitations.* (a) No airplane shall be taken off from any airport located at an elevation outside of the altitude range for which maximum take-off weights have been determined, and no airplane shall depart for an airport of intended designation, or have any airport specified as an alternate, which is located at an elevation outside of the altitude range for which maximum landing weights have been determined.

(b) The weight of the airplane at take-off shall not exceed the authorized maximum take-off weight for the elevation of the airport from which the take-off is to be made.

(c) The weight at take-off shall be such that, allowing for normal consumption of fuel and oil in flight to the airport of intended destination, the weight on arrival will not exceed the authorized maximum landing weight for the elevation of such airport.

§ 42.72 *Take-off limitations to provide for engine failure.* No take-off shall be made except under conditions which will permit compliance with the following requirements.

(a) It shall be possible, from any point on the take-off up to the time of attaining the critical-engine-failure speed, to bring the airplane to a safe stop on the runway, as shown by the accelerate-stop distance data.

(b) It shall be possible, if the critical engine should fail at any instant after the airplane attains the critical-engine-failure speed, to proceed with the take-off and attain a height of 50 feet, as indicated by the take-off path data, before passing over the end of the take-off area. Thereafter, it shall be possible to clear all obstacles, either by at least 50 feet vertically, as shown by the take-off path data, or by at least 200 feet horizontally within the airport boundaries and by at least 300 feet horizontally after passing beyond such boundaries.

(1) In determining the allowable deviation of the flight path in order to avoid obstacles by at least the distances above set forth, it shall be assumed that the airplane is not banked before reaching a height of 50 feet, as shown by the take-off path data, and that a maximum bank thereafter does not exceed 15°.

(c) In applying conditions in paragraphs (a) and (b) of this section, correction shall be made for any gradient of the take-off surface. Take-off data based on still air may be corrected to allow for the effect of a favorable wind according to reported wind conditions: *Provided*, That not more than 50% of the wind component along the direction of take-off may be used.[9]

§ 42.73 *En route limitations; all engines operating.* No airplane shall be taken off at a weight in excess of that which would permit a rate of climb (expressed in feet per minute), with all engines operating, of at least 6 V_{s_0} (when V_{s_0} is expressed in miles per hour) at an altitude of at least 1,000 feet above the elevation of the highest ground or obstruction within 10 miles of either side of the intended track. Transport category airplanes certificated under Part 4a of this chapter are not required to comply with this section. For the purpose of this section it shall be assumed that the weight of the airplane as it proceeds along its intended track is progressively reduced by the anticipated consumption of fuel and oil.

§ 42.74 *En route limitations; one engine inoperative.* No airplane of a maximum certificated weight of less than 40,000 lbs. shall be taken off at a weight in excess of that which would permit a rate of climb (expressed in feet per minute), with one engine inoperative, of at least 0.02 $V_{s_0}^2$ (when V_{s_0} is expressed in miles per hour) at an altitude of at least 1,000 feet above the elevation of the highest ground or obstruction within 10 miles either side of the intended track; for airplanes of a maximum certificated weight of 40,000 to 60,000 lbs., inclusive, the rate of climb shall increase linearly in relation to weight to 0.04 $V_{s_0}^2$; for airplanes of a maximum certificated weight of over 60,000 lbs. the rate of climb shall be 0.04 V_{s_0}; for transport category airplanes certificated under Part 4a of this chapter the rate of climb shall be 0.02 $V_{s_0}^2$ for all maximum certificated weights. For the purpose of this section it shall be assumed that the weight of the airplane as it proceeds along its intended track is progressively reduced by the anticipated consumption of fuel and oil.

§ 42.75 *En route limitations; two engines inoperative.* No airplane having four or more engines shall be flown along an intended track except under the following conditions: *Provided*, That this section shall not apply to transport category airplanes certificated under Part 4a of this chapter:

(a) No place along the intended track shall be more than 90 minutes away from an available landing area at which a landing may be made in accordance with the requirements of § 42.73, assuming all engines are operating at cruising speed; or

(b) The take-off weight is such that the airplane with two engines inoperative shall have a rate of climb (expressed in feet per minute) of at least 0.01 $V_{s_0}^2$ (when V_{s_0} is expressed in miles per hour) either at an altitude of 1,000 feet above the elevation of the highest ground or obstruction within 10 miles on either side of the intended track or at an altitude of 5,000 feet, whichever is higher.

(1) The rate of climb referred to in this paragraph shall be determined by assuming the airplane's weight to be either that attained at the moment of failure of the second engine, assuming that failure to occur 90 minutes after departure, or that which may be attained by dropping fuel at the moment of failure of the second engine, assuming that sufficient fuel is retained to arrive at an altitude of at least 1,000 feet directly over the landing area.

§ 42.76 *En route limitations; where special air navigational facilities exist.* The 10-mile lateral distance specified in §§ 42.73 through 42.76 may, for a distance of no more than 20 miles, be reduced to 5 miles: *Provided*, That special air navigational facilities provide a reliable and accurate identification of any high ground or obstruction located outside of such 5-mile lateral distance but within the 10-mile distance.

§ 42.77 *Landing distance limitations; airport of destination.* No airplane shall be taken off at a weight in excess of that which, under the conditions stated hereinafter in paragraphs (a) and (b) of this section, would permit the airplane to be brought to rest at the field of intended destination within 60% of the effective length of the runway from a point 50 feet directly above the intersection of the obstruction clearance line and the runway. For the purpose of this section it shall be assumed that the take-off weight of the airplane is reduced by the weight of the fuel and oil expected to be consumed in flight to the field of intended destination.

(a) It shall be assumed that the aircraft is landed on the most favorable runway and direction without regard to wind.

(b) It shall be assumed, considering every probable wind velocity and direction, that the aircraft is landed on the most suitable runway, taking due account of the ground handling characteristics of the airplane and allowing for the effect on the landing path and roll of not more than 50% of the favorable wind component.

(c) If the airport of intended destination will not permit full compliance with paragraph (b) of this section, the aircraft may be taken off if an alternate airport is designated which permits compliance with § 42.78.

§ 42.78 *Landing distance limitations; alternate airports.* No airport shall be designated as an alternate airport in a flight plan unless the aircraft at the weight at take-off can comply with the requirements of paragraphs (a) and (b) of § 42.77 at such airport: *Provided*, That the aircraft can be brought to rest within 70% of the effective length of the runway.

§ 42.80 *Operating limitations for aircraft not certificated in the transport category.* In operating any passenger-carrying, large, nontransport category airplanes after January 1, 1950, the provisions of §§ 42.81 through 42.83 shall be complied with. Prior to that date, such aircraft shall be operated in accordance with such operating limitations as the Administrator determines will provide a safe relation between the performance of the aircraft and the airports to be used and the areas to be traversed. Performance data published by the Administrator for each such nontransport category type aircraft shall be used in determining compliance with these provisions.

§ 42.81 *Take-off limitations.* No take-off shall be made except under conditions which will permit the airplane to be brought to a safe stop within the effective length of the runway from any

[9] It will be noted that Special Civil Air Regulation Serial Number 397 requires the pilot to take account of temperature variations as well as his wind component in take-off.

point on take-off up to the time of attaining, with all engines operating at normal take-off power, 105% of the minimum control speed or 115% of the power-off stall speed in the take-off configuration, whichever is greater, as shown by the accelerate-stop distance data.

(a) In applying this requirement take-off data shall be based upon still-air conditions, and no correction shall be made for any uphill gradient of 1% or less when such percentage is measured as the difference between elevation at the end points of the runway divided by the total length. For all uphill gradients greater than 1%, the effective take-off length of the runway shall be reduced 20% for each 1% grade.

§ 42.82 *En route limitations; one engine inoperative.* No airplane shall be taken off at a weight in excess of that which, with the critical engine inoperative, would permit a rate of climb of at least 50 feet per minute at an altitude of at least 1,000 feet above the elevation of the highest ground or obstruction within 10 miles of either side of the intended track or at an altitude of 5,000 feet, whichever is higher. For the purpose of this section it shall be assumed that the weight of the airplane as it proceeds along its intended track is progressively reduced by the anticipated consumption of fuel and oil; that the propeller of the inoperative engine is in the minimum drag position; that the wing flaps and landing gear are in the most favorable positions; and that the remaining engine or engines are operating at the maximum continuous power available. The 10-mile lateral distance specified herein may, for a distance of no more than 20 miles, be reduced to 5 miles provided that special air navigational facilities provide a reliable and accurate identification of any high ground or obstruction located outside of such 5-mile lateral distance but within the 10-mile distance.

§ 42.83 *Landing distance limitations; airport of destination.* No airplane shall be taken off at a weight in excess of that which, under the conditions hereinafter stated in paragraphs (a) and (b) of this section, would permit the airplane to be brought to rest at the field of intended destination within 70% of the effective length of the runway from a point 50 feet directly above the intersection of the obstruction clearance line and the runway. For the purpose of this section it shall be assumed that the take-off weight of the airplane is reduced by the weight of the fuel and oil expected to be consumed in flight to the field of intended destination.

(a) It shall be assumed that the aircraft is landed on the most favorable runway and direction without regard to wind.

(b) It shall be assumed, considering every possible wind velocity and direction, that the aircraft is landed on the most suitable runway, taking due account of the ground handling characteristics of the airplane and allowing for the effect on the landing path and roll of not more than 50% of the favorable wind component.

(c) If the airport of intended destination will not permit full compliance with paragraph (b) of this section, the aircraft may be taken off if an alternate airport is designated which permits compliance with paragraphs (a) and (b) of this section.

REQUIRED RECORDS AND REPORTS

§ 42.91 *Maintenance records.* Each air carrier shall keep at its principal operations base the following current records with respect to all aircraft, aircraft engines, propellers, and, where practicable, appliances used in air transportation:

(a) Total time and service,
(b) Time since last overhaul,
(c) Time since last inspection, and
(d) Mechanical failures.

§ 42.92 *Airman records.* An air carrier shall maintain at its principal operations base current records of every airman utilized as a member of a flight crew. These records shall contain such information concerning the qualifications of each airman as is necessary to show compliance with the appropriate requirements prescribed by the Civil Air Regulations. No air carrier shall utilize any airman as a flight crew member unless records are maintained for such airman as required herein.

§ 42.93 *Emergency flight reports.* In the case of emergencies necessitating the transportation of persons or medical supplies for the protection of life or property, the rules contained herein regarding type of aircraft, equipment, and weather minimums to be observed will not be applicable: *Provided,* That within 48 hours after any such flight returns to its base the air carrier shall file a report with the Administrator setting forth the conditions under which the flight was made, the necessity therefor, and giving the names and addresses of the crew and passengers.

§ 42.94 *Pilot's emergency deviation report.* Where pursuant to authority granted in § 42.51 (d) a pilot has deviated from established methods or requirements, he shall, within 7 days after completion of the trip, file with the Administrator a report thereof giving a brief statement concerning the circumstances of the emergency and the nature of the deviation.

§ 42.95 *Flight manifest record.* A signed copy and any revision of the flight manifest required by § 42.62 shall be retained in the personal possession of the pilot for the duration of the flight, and a duplicate copy thereof shall be retained by the air carrier at its principal operations base for at least one year after completion of the flight.

§ 42.96 *Reporting of malfunctioning and defects.* An air carrier shall report in a manner prescribed by the Administrator all malfunctioning and defects occurring during operation or discovered during inspection which cause or may be reasonably expected by the air carrier to cause an unsafe condition in any aircraft, engine, propeller, or appliance. The corrective action taken by the air carrier to prevent recurrence of the malfunctioning or defect shall be indicated.

PART 43—GENERAL OPERATION RULES

AUTHORITY: §§ 43.1 to 43.70 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply sec. 601, 52 Stat. 1007; 49 U. S. C. 551.

SOURCE: §§ 43.1 to 43.70 contained in Amendment 43-0, Civil Air Regulations, 10 F. R. 5062, 5393, except as noted following sections affected.

GENERAL

§ 43.1 *Scope.* This part governs the operation of civil aircraft in the United States.

AIRCRAFT CERTIFICATION AND IDENTIFICATION

§ 43.10 *Certificates and identification marks.* Aircraft, except foreign aircraft authorized by the Administrator to be flown in the United States, shall not be operated unless the following requirements are met:

(a) *Registration certificate.* A registration certificate issued to the owner of the aircraft shall be carried in the aircraft at all times.

NOTE: The owner of an aircraft is required to give immediate notice to the Administrator of any change of address. For other rules governing the registration and recordation of aircraft ownership see Parts 501 and 503 of this title.

(b) *Airworthiness certificate.* An airworthiness certificate or special authorization issued by the Administrator approving its operation shall be carried in the aircraft at all times during flight.

NOTE: Usually the manufacturer obtains the airworthiness certificate which thereafter remains with the aircraft. If no airworthiness certificate has been issued for the aircraft, or if it has expired, the owner shall obtain this certificate.

(1) *Aircraft operating limitations.* An aircraft for which an airworthiness certificate is currently in effect shall not be operated unless there are available in the aircraft appropriate aircraft operating limitations set forth in a form and manner prescribed by the Administrator, or a current airplane flight manual approved by the Administrator; nor shall such aircraft be operated otherwise than within its prescribed operating limitations.

NOTE: Special Regulation Serial No. SR-330, effective February 28, 1949, 14 F. R. 1004, provides in part as follows:

Notwithstanding the provisions of § 43.10 (b) (1) of this chapter, military personnel of a foreign government being trained in a CAA certificated school may receive special training in maneuvers not within the approved airplane operating limitations: *Provided*, That;

(1) An official request for such special training has been made to the Administrator by an accredited representative of the foreign government concerned; and

(2) The Administrator finds that such training can be done with a standard of safety equivalent to that maintained by the United States Air Force and Navy. There shall be no violation of the United States Air Force or Navy Technical Orders pertinent to the phase of the training for which approval is being given.

(3) Such aircraft shall not be used to demonstrate compliance with any acrobatic maneuver required in a flight test for the issuance of an airman certificate or rating, against which it has been placarded.

(2) *Duration.* An airworthiness certificate shall remain in effect until a termination date is fixed by the Board, unless it is suspended or revoked.

(3) *Transferability.* The airworthiness certificate and the attached currently effective aircraft operation record, upon transfer of ownership, shall remain with the aircraft for which they were issued.

(4) *Surrender.* Upon the cancellation, suspension, or revocation of an airworthiness certificate the owner of the aircraft must, upon request, surrender such certificate to an authorized representative of the Administrator.

(c) *Identification marks.* Aircraft identification marks shall be displayed on aircraft in the manner prescribed by the Administrator. Aircraft identification marks are as follows:

(1) *NC.* Roman capital letters NC followed by the registration symbols shall be displayed on aircraft which fully comply with the minimum airworthiness requirements specified in this subchapter.

(2) *NR.* Roman capital letters NR followed by the registration symbols shall be displayed on aircraft which fully comply with the airworthiness requirements of this subchapter, except those rendered inapplicable by the nature of a special purpose for which the aircraft is to be used, and the airworthiness requirements not met are compensated by suitable operating restrictions imposed by the Administrator after making a finding that the aircraft, when operated for the special purpose in accordance with the restrictions placed thereon, provides a level of safety equivalent to that of an aircraft which fully meets the provisions of the airworthiness requirements of this subchapter. NR aircraft may carry passengers and cargo but no charge shall be made for such transportation. For the purpose of this section, the materials transported for crop dusting, seeding, and other specialized operations shall not be considered pay cargo.

(3) *NX.* Roman capital letters NX followed by the registration symbols shall be displayed on aircraft which have not fully complied with the airworthiness requirements specified in the regulations in this subchapter and are to be operated only for experimental purposes when, in the opinion of the Administrator, such aircraft can be operated with appropriate restrictions without endangering public safety. In addition, the word "experimental" shall be prominently displayed near the entrance to the cabin or cockpit of any aircraft holding an experimental certificate.

(4) *Other marks or symbols.* (i) No design, mark, or symbol which modifies the identification marks shall be placed on aircraft, except with the approval of the Administrator.

(ii) No design, mark, or symbol which confuses the identification mark shall be placed on the aircraft.

(5) *NL.* Roman capital letters NL followed by the registration symbols shall be displayed on aircraft which have complied with the airworthiness requirements specified in Part 9 of this subchapter. Such aircraft shall not carry passengers or cargo for compensation or hire. A placard shall be prominently displayed in the passenger compartment of the aircraft bearing the words, "This is a military category aircraft and under the Civil Air Regulations shall not be used for the carriage of passengers or cargo for compensation or hire." The Administrator shall prescribe the dimensions of the placard and the lettering and the location of the placard.

(6) *Alternate identification marks.* After December 31, 1948, aircraft registered for the first time and, after December 31, 1950, all aircraft shall display identification marks consisting of the Roman capital letter "N" denoting U. S. registration followed by the registration number. However, this identification mark may be displayed prior to these dates at the option of the owner of the aircraft. When this identification mark is utilized, those aircraft having other than a standard airworthiness certificate shall display the appropriate airworthiness classification as prescribed in Parts 3, 4a, 4b, 6, and 9 of this subchapter on the aircraft in a manner and form prescribed by the Administrator. Those aircraft having a standard airworthiness certificate need not display the airworthiness classification designation.

(d) *Export aircraft.* An aircraft manufactured in the United States for delivery outside the United States or its possessions shall display such identification marks or insignia as are approved by the Administrator. Such aircraft shall be operated only for the purpose of test and demonstration flights for a limited period of time or while in necessary transit to the purchaser.

[Amdt. 43-0, 10 F. R. 5062, 5393 as amended by Amdt. 43-4, 11 F. R. 1883, Amdt. 43-6; 11 F. R. 14099, Amdt. 43-1, 13 F. R. 474, Amdt. 43-3, 13 F. R. 2966, and Amdt. 43-5, 14 F. R. 2197]

§ 43.10-1 *Identification marks and airworthiness classification marks (CAA rules which apply to § 43.10 (c)*—(a) *Identification marks*—(1) *Composition.* On each aircraft, identification marks shall be displayed. They shall consist of the roman capital letter "N" denoting United States registry, followed by Arabic registration numbers, followed in some instances by an additional roman capital letter.

(2) *Location.* (i) On each fixed-wing aircraft, identification marks shall be displayed on the right half of the upper surface and the left half of the lower surface of the wing structure. So far as possible, the marks shall be located an equal distance from the leading and trailing edges of the wing. The top of the marks shall be toward the leading edge of the wing.

On each fixed-wing aircraft, identification marks shall be displayed on the upper half of the vertical tail surface. They shall be displayed on both sides of a single-tail surface, and on the outer sides of a multitail surface. They may be placed either horizontally or vertically.

On each fixed-wing aircraft, identification marks shall be displayed on the fuselage when the aircraft, as a result of design, does not have a vertical tail surface. The marks shall be located on each side of the top half of the fuselage, just forward of the leading edge of the horizontal tail surface. They may be placed either horizontally or vertically.

(ii) On each rotorcraft, identification marks shall be displayed on the bottom surface of the fuselage or cabin. The top of the marks shall be toward the left side of the fuselage.

On each rotorcraft, identification marks shall be displayed below the window lines and as near the cockpit as possible.

(iii) On each airship, identification marks shall be displayed on the upper surface of the right horizontal stabilizer and on the under surface of the left horizontal stabilizer. The top of the marks shall be toward the leading edge of the stabilizer. The marks shall be placed horizontally.

On each airship, identification marks shall be displayed on each side of the bottom half of the vertical stabilizer. The marks shall be placed horizontally.

(iv) On each spherical balloon, identification marks shall be displayed on two places diametrically opposite, and shall be located near the maximum horizontal circumference of the balloon.

(v) On each nonspherical balloon, identification marks shall be displayed on each side. They shall be located near the maximum cross section of the balloon, immediately above either the rigging band, or the points of attachment of the basket or cabin suspension cables.

(3) *Height.* (i) On each fixed-wing aircraft, wing identification marks shall be at least 20 inches high.

On each fixed-wing aircraft, vertical tail surface or fuselage identification marks shall be at least 2 inches high, but need not be more than 6 inches high.

(ii) On each rotorcraft, fuselage bottom surface or cabin bottom surface identification marks shall be at least ⅘ as high as the fuselage is wide, but need not be more than 20 inches high.

On each rotorcraft, fuselage side identification marks shall be not less than 2 inches high, but need not be more than 6 inches high.

(iii) On each airship, spherical balloon, or nonspherical balloon, identification marks shall be at least 20 inches high.

(4) *Width.* On each aircraft, identification marks, with the following exception, shall be at least ⅔ as wide as they are high. Number "1" shall be ⅙ as wide as it is high.

On each aircraft, lines forming the identification marks shall be ⅙ as wide as they are high.

(5) *Spacing.* On each aircraft, the space between identification marks shall be not less than ⅙ as wide as the marks are high.

(6) *Color.* On each aircraft, identification marks shall contrast in color with the background.

(7) *Affixation.* On each aircraft, identification marks shall be painted or shall be affixed by any other means insuring a similar degree of permanence.

(8) *Formation.* On each aircraft, identification marks shall be formed by solid lines.

(9) *Design.* On each aircraft, identification marks shall have no ornamentation.

(10) *Maintenance.* On each aircraft, identification marks shall be kept clean and legible at all times.

(b) *Airworthiness classification marks*—(1) *Composition.* (i) On each aircraft for which a limited certificate of airworthiness has been issued, the mark "Limited" shall be displayed.

(ii) On each aircraft for which a restricted airworthiness certificate has been issued, the mark "Restricted" shall be displayed.

(iii) On each aircraft for which an experimental airworthiness certificate has been issued, the mark "Experimental" shall be displayed.

On each aircraft for which a standard certificate of airworthiness has been issued, and which has been altered by the installation of components for temporary experimental purposes so as not to adversely affect the aircraft design or flight characteristics, the mark "Experimental" shall be displayed.

(2) *Location.* On each aircraft, required airworthiness classification marks shall be placed on the fuselage at each cabin entrance and cockpit entrance so as to be readily visible to passengers and crew entering the aircraft. In cases where only one entrance for passengers and crew is used, and persons may enter the aircraft from either side of the fuselage, such as an aircraft with a sliding canopy, the marks shall be displayed on both sides of the fuselage.

(3) *Height.* On each aircraft, required airworthiness classification marks shall be at least 2 inches high, but need not be more than 6 inches high.

(4) *Width.* On each aircraft, required airworthiness classification marks shall be ⅔ as wide as they are high.

On each aircraft, lines forming required airworthiness classification marks shall be ⅙ as wide as they are high.

(5) *Spacing.* On each aircraft, the space between required airworthiness classification marks shall be not less than ⅙ as wide as the marks are high.

(6) *Color.* On each aircraft, required airworthiness classification marks shall contrast in color with the background.

(7) *Affixation.* On each aircraft, required airworthiness classification marks shall be painted or shall be affixed by any other means insuring a similar degree of permanence.

On each aircraft for which a standard airworthiness certificate has been issued, and for which an experimental certificate of airworthiness has been subsequently issued to permit temporary experiments, the "Experimental" marks may be applied free-hand with water paint or masking tape, or by any other method which will allow the marks to be removed easily at the termination of the experiments.

(8) *Formation.* On each aircraft, required airworthiness classification marks shall be formed by solid lines.

(9) *Design.* On each aircraft, required airworthiness classification marks shall have no ornamentation.

(10) *Maintenance.* On each aircraft, required airworthiness classification marks shall be kept clean and legible.

[13 F. R. 7659]

MAINTENANCE

§ 43.20 *General.* An aircraft shall not be flown unless it is in airworthy condition. Mechanical work other than routine maintenance must be performed in accordance with § 18.10 of this subchapter.

§ 43.21 *Flight tests.* When an aircraft has undergone any repair or alteration which may have appreciably changed its flight characteristics or substantially affected its operation in flight, such aircraft, prior to carrying passengers, shall be test flown by at least a private pilot appropriately rated for the aircraft, and a notation to that effect shall be entered by such pilot in the aircraft log.

§ 43.22 *Inspections*—(a) *Annual inspection.* An aircraft shall not be flown, except for airworthiness flight tests, unless within the preceding 12 calendar months it has been given an annual inspection as prescribed by the Administrator and has been found to be airworthy by a person designated by the Administrator.

(b) *Periodic inspection.* An aircraft shall not be flown for hire, unless within the preceding 100 hours of flight time it has been given a periodic inspection by an appropriately rated mechanic in accordance with the periodic inspection report form prescribed by the Administrator, has been found to be airworthy, and a notation to that effect has been entered by such mechanic in the aircraft log. The annual inspection required by paragraph (a) of this section will be accepted as one such periodic inspection.

(c) *Air carrier exemption.* Air carrier aircraft are exempted from paragraphs (a) and (b) of this section when such aircraft are maintained and inspected in accordance with a continuous maintenance and inspection system as provided for by Part 41, 42, or 61 of this subchapter.

[Amdt. 43-10, 12 F. R. 6378]

§ 43.22-1 *Annual inspection routine (CAA rules which apply to § 43.22).* (a) The following procedure is prescribed for annual inspections of aircraft, other than air carrier aircraft coming within the provision of § 43.22 (c):

(1) The aircraft shall be given an inspection by an appropriately certificated mechanic and certified as airworthy on an inspection form prescribed by the Administrator.

(2) A representative of the Administrator must then determine if the aircraft complies with all current airworthiness requirements. Such representative may be either an agent employed by the Civil Aeronautics Administration or a designated aircraft maintenance inspector.

(b) A designated aircraft maintenance inspector may conduct the required periodic inspection and at the same time complete the necessary inspection forms for annual inspection.

(c) The certificate of airworthiness furnished by the Administrator setting forth the date of the annual inspection shall be prominently displayed in and affixed to the aircraft by the representative, preferably in a rear window facing the outside of the aircraft and so located as not to unduly limit the pilot's visibility.

[12 F. R. 8767. Corrections noted at 14 F. R. 38]

§ 43.23 *Aircraft and engine records.* The registered owner of a certificated aircraft shall be responsible for maintaining and keeping available for inspection by an authorized representative of the Administrator or the Board and for transfer with the aircraft or engine the following records:

(a) Aircraft and engine records which shall contain a current, accurate, and permanent record including the flight time of the aircraft and each engine, reports of inspections, minor repairs, and minor alterations of the aircraft structure, engines, and propellers. A mechanical device which records the total time of operation or the total number of engine revolutions may be used in lieu of individual flight entries: *Provided,* That the totals of flight time are recorded in the aircraft and engine records at periodic intervals to enable compliance with the required inspections and maintenance procedures.

(b) A record of major repairs and alterations shall be maintained as required by Part 18 of this subchapter. A reference to such major repairs and alterations shall be entered in the appropriate place in the aircraft records.

[Amdt. 43-2, 13 F. R. 474]

§ 43.24 *Rebuilt engine logs.* A new record without previous operating history may be used for an aircraft engine rebuilt by the manufacturer or any agency approved by the manufacturer for such work, provided such new record contains a signed statement by such manufacturer or agency giving the date the engine was rebuilt and such other information as the Administrator may require.

AIRCRAFT INSTRUMENTS AND EQUIPMENT

§ 43.30 *Instruments and equipment for NC powered aircraft or powered aircraft with standard airworthiness certificates.* The following instruments and equipment, or instruments and equipment which the Administrator has found to be the equivalent, are required for the particular category of operation specified:

(a) *Contact flight rules (day).* (1) Air-speed indicator.

(2) Altimeter.

(3) Magnetic direction indicator.

(4) Tachometer for each engine.

(5) Oil pressure gauge for each engine using pressure system.

(6) Temperature gauge for each liquid-cooled engine.

(7) Oil temperature gauge for each air-cooled engine.

(8) Manifold pressure gauge, or equivalent, for each altitude engine.

(9) Fuel gauge indicating the quantity of fuel in each tank.

(10) Position indicator, if aircraft has retractable landing gear.

(11) Approved flotation gear readily available for each occupant and a Very pistol or equivalent signal device, if the aircraft is operated for hire over water beyond gliding distance from shore without the aid of power.

(12) Certificated safety belts for all passengers and members of the crew.

(b) *Contact flight rules (night).* (1) Equipment specified in paragraph (a) of this section.

(2) Set of certificated forward and rear position lights.

(3) One electric landing light, if the aircraft is operated for hire.

(4) Certificated landing flares as follows, if the aircraft is operated for hire beyond a 3-mile radius from the center of the airport of take-off:

Maximum authorized weight of aircraft:
3,500 pounds or less: five class 3 or three class 2 flares.
3,500 pounds to 5,000 pounds: four class 2 flares.
Above 5,000 pounds: two class 1 or three class 2 and one class 1 flares.

If desired, flare equipment specified for heavier aircraft may be used.

(5) An adequate source of electrical energy for such electrical and radio equipment as is installed.

(6) One spare set of fuses or 3 spare fuses of each magnitude.

(c) *Instrument flight rules.* (1) Equipment specified for contact flight rules in paragraph (a) of this section and, for night flight, equipment specified in paragraph (b) of this section.

(2) Two-way radio communications system and navigational equipment appropriate to the ground facilities to be used.

(3) Gyroscopic rate-of-turn indicator.

(4) Bank indicator.

(5) Sensitive altimeter adjustable for change in barometric pressure.

(6) Clock with a sweep second hand.

(7) Generator of adequate capacity.

[Amdt. 43-0, 10 F. R. 5062 as amended by Amdt. 43-3, 13 F. R. 2966, and Amdt. 43-5, 14 F. R. 2197]

§ 43.40 *Pilot certificate.* No person shall pilot a civil aircraft within the United States unless he has in his personal possession at all times while piloting aircraft a valid pilot certificate with appropriate ratings issued by the Administrator, or an appropriate and valid foreign pilot certificate and ratings. Such certificate shall be presented for examination to any inspector of the Administration or State or local law enforcement officer upon the request of such inspector or enforcement officer.

[Amdt. 43-5, 14 F. R. 2197]

§ 43.41 *Medical certificate and renewal.* No person shall pilot an aircraft under authority of a pilot certificate issued by the Administrator, unless he has in his personal possession at all times while piloting aircraft a medical certificate or other evidence satisfactory to the Administrator showing that he has met the physical requirements appropriate to his rating within the following time limits:

(a) *Student or private pilot.* 24 calendar months.

(b) *Commercial pilot.* 12 calendar months, or 24 calendar months for operations requiring only a private pilot rating.

(c) *Air-line transport pilot.* Six calendar months, or 12 calendar months for operations requiring only a commercial pilot rating, or 24 calendar months for operations requiring only a private pilot rating.

[Amdt. 43-9, 12 F. R. 3170]

§ 43.42 *Operation during physical deficiency.* A person shall not pilot any aircraft during a period of any known physical deficiency or increase in physical deficiency which would render him unable to meet the physical requirements prescribed for the issuance of his currently effective medical certificate.

§ 43.43 *Pilot logbooks.* A record of the flight time used to substantiate recent experience or qualification for certificates or ratings shall be kept in a bound logbook. The logging of other flight time is not required. Such record shall show:

(a) Date of flight, duration of flight, and the points between which such flight was made,

(b) Category and type of the aircraft flown, the airplane class and engine horsepower,

(c) Aircraft identification mark,

(d) Dual instruction endorsed by a rated instructor, solo, pilot in command, instrument, and night flying time.

[Amdt. 43-0, 10 F. R. 5062, 5063, as amended by Amdt. 43-5, 14 F. R. 2197]

§ 43.44 *Logging of flight time*—(a) *Student.* A student pilot may log as solo only that time during which he is the sole occupant of the aircraft in flight.

(b) *Private and commercial*—(1) *Pilot in command.* A private or commercial pilot may log flight time as pilot in command that flight time during which he is the sole manipulator of the controls of an aircraft for which he is rated or that flight time during which he is the sole occupant of the aircraft. A flight instructor may log flight time as pilot in command that flight time during which he is serving as a flight instructor. All flight time so logged may be credited toward the total flight time required for a higher pilot rating.

(2) *Copilot.* A private or commercial pilot may log as copilot time that flight time during which he is performing the duties of a copilot. Such pilot shall be entitled to credit not more than 50% of such flight time toward the total flight time required for a higher grade of pilot rating, but in no event shall a private pilot be entitled to credit more than 50 hours of such flight time.

(c) *Instrument time.* Instrument flight time may be logged as such by the pilot actually manipulating the controls only when the aircraft is flown solely by reference to instruments either under actual or simulated instrument flight conditions.

[Amdt. 43-0, 10 F. R. 5062, 5063, as amended by Amdt. 43-5, 14 F. R. 2197]

§ 43.45 *Use of liquor, narcotics, and drugs.* No person shall pilot an aircraft or serve as a member of the crew while under the influence of intoxicating liquor or use any drug which affects his faculties in any manner contrary to safety. A pilot shall not permit any person to be carried in the aircraft who is obviously under the influence of intoxicating liquor or drugs, except a medical patient under proper care or in case of emergency.

§ 43.46 *Towing by aircraft.* No pilot shall tow anything by aircraft unless authority for such operation has been issued by the Administrator.

§ 43.47 *Dropping objects.* No person piloting an aircraft shall permit anything to be dropped from an aircraft in flight which might create any hazard to persons or property.

§ 43.48 *Aerobatic flight.* No pilot shall intentionally fly an aircraft in aerobatic flight carrying passengers unless all occupants are equipped with approved parachutes.

§ 43.49 *Parachutes.* No pilot shall carry on an aircraft a parachute which is available for emergency use unless:

(a) It is an approved chair-type (canopy in back) parachute which has been packed by a qualified parachute rigger within the preceding 120 days; or

(b) It is an approved-type, other than a chair-type (canopy in back) parachute which has been packed by a qualified parachute rigger within the preceding 60 days.

[Amdt. 43-7, effective July 21, 1949, 14 F. R. 3373]

§ 43.50 *Transportation of explosives and other dangerous articles.* No person piloting an aircraft shall permit explosives or other dangerous articles such as inflammable liquids or solids, oxidizing material, corrosive liquid, inflammable or noninflammable compressed gas, poison gas or liquid, poisonous liquid or solid, or tear gas to be carried in aircraft, except as provided for in Part 49 of this subchapter. Small arms ammunition for personal use, necessary aircraft signaling devices, and equipment necessary to safe operation of the aircraft are permitted.

§ 43.51 *Fuel supply.* Aircraft operated under IFR conditions shall carry sufficient fuel, considering weather reports and forecasts of wind and other weather conditions, to complete the flight to the point of first intended landing, to fly from there to the alternate airport, and to fly thereafter for 45 minutes at normal cruising speed.

[Amdt. 43-4, 13 F. R. 3781]

STUDENT PILOT LIMITATIONS

§ 43.52 *General limitations.* No student pilot shall pilot an aircraft carrying a passenger, or on an international flight, or for compensation or hire, or in furtherance of a business.

[Amdt. 43-5, 14 F. R. 2197]

§ 43.53 *Requirements for first solo.* A student pilot shall not operate an aircraft in solo flight until:

(a) He has passed a written examination on pertinent provisions of this part and those of Part 60 of this subchapter dealing with contact flight rules,

(b) He has been found competent by a flight instructor to make such flight and authority therefor has been endorsed by such instructor on the student pilot certificate, and

(c) He has been given instruction in the prevention of and recovery from power-on and power-off stalls entered from all normally anticipated flight attitudes.

[Amdt. 43-8, 12 F. R. 1417, as amended by Amdt. 43-8, 14 F. R. 3352]

NOTE: § 43.53 (c) was amended, effective Aug. 15, 1949, by Amdt. 43-8.

§ 43.54 *Flight area limitations.* A student shall not pilot an aircraft outside a local flying area designated by his flight instructor until:

(a) He has had at least 10 solo flight hours, or if enrolled in and receiving flying instruction from an approved air agency, he is deemed competent by such agency, and

(b) His student pilot certificate has been appropriately endorsed by a flight instructor.

[Amdt. 43-11, 12 F. R. 7067]

§ 43.55 *Aircraft limitations.* A student shall not pilot an aircraft other than that of the category, class, and type which has been endorsed on his student pilot certificate by a flight instructor.

[Amdt. 43-0, 10 F. R. 5062, 5063, as amended by Amdt. 43-5, 14 F. R. 2197]

§ 43.56 *Recent experience.* A student who has not piloted a powered aircraft within 90 days shall not pilot such aircraft in solo flight until he has passed a flight check given by a flight instructor and that fact has been endorsed by such instructor in the student pilot logbook.

PRIVATE AND COMMERCIAL PILOT PRIVILEGES AND LIMITATIONS

§ 43.60 *Private pilot.* A private pilot shall not pilot aircraft for hire.

NOTE: This section permits sharing the expenses of a flight or piloting aircraft in furtherance of a business when the flight is made solely for the personal transportation of the pilot.

§ 43.61 *Commercial pilot.* A commercial pilot may pilot aircraft for hire.

§ 43.62 *Air-line transport pilot.* An air-line transport pilot may exercise the privileges of a commercial pilot with an instrument rating.

§ 43.63 *Rating requirements.* A private or commercial pilot shall not pilot an aircraft carrying passengers other than an aircraft of the category, class, and type for which he is rated: *Provided,* That a holder of a pilot certificate with appropriate category and class ratings issued by the Administrator prior to May 1, 1949, shall not, until May 1, 1953, be required to have a type rating to pilot aircraft of over 12,500 lbs. maximum certificated take-off weight for which he has appropriate category and class ratings.[1] Such pilot may pilot other aircraft without passengers unless limitations placed on his certificate prohibit him from doing so.[2]

[Amdt. 43-5, 14 F. R. 2198]

§ 43.64 *Flight instruction limitations.* This section governs flight instructions:

(a) *Aircraft.* Aircraft shall be equipped with fully functioning dual controls.

(b) *Flight time.* A flight instructor shall not give more than 8 hours of dual flight instruction in any one day and not more than 36 hours of dual flight instruction in any 7-day period.

(c) *Endorsement of student pilot certificates.* A flight instructor shall endorse the certificate of any student pilot for solo flight or flight in different categories, classes, and types of aircraft only if he has determined that the student is competent to exercise such privileges with safety, and for cross-country flight only if he has additionally determined that the student has an elementary knowledge of aeronautical charts, meteorological data, and the use of a magnetic compass.

[Amdt. 43-0, 10 F. R. 5062, 5063, as amended by Amdt. 43-5, 14 F. R. 2197]

§ 43.65 *Instrument flight limitations.* A pilot shall not pilot aircraft under instrument flight rules, unless he holds a valid instrument rating issued by the Administrator.

§ 43.66 *Instrument flight instruction.* Instrument flight instruction may be given only by a person holding an effective instrument rating. A flight instructor rating is not required.

§ 43.67 *Simulated instrument flight.* Aircraft shall not be flown under simulated instrument flight conditions unless:

(a) Fully functioning dual controls are installed in the aircraft,

(b) An appropriately rated pilot occupies the other control seat as safety pilot, and

(c) Such safety pilot at all times has adequate vision forward and to either side of the aircraft, or a competent observer occupies a position in the aircraft so that his field of vision adequately supplements that of the safety pilot.

§ 43.68 *Recent flight experience.* This section governs recent flight experience:

(a) *General.* No person shall pilot an aircraft carrying passengers unless within the preceding 90 days he has made at least 5 take-offs and landings to a full stop in aircraft of the same category, class, and type of aircraft to be flown.

(b) *Night flight.* No person shall pilot an aircraft carrying passengers during the period from one hour after sunset to one hour before sunrise, unless he has made at least 5 take-offs and landings to a full stop during such period within the preceding 90 days.

(c) *Instruction flight.* A flight instructor shall not exercise the privileges of the instructor rating unless within the preceding 12 calendar months he has either:

(1) Given at least 10 hours of flight instruction while appropriately rated, or

(2) Demonstrated his continued proficiency to the Administrator.

(d) *Instrument flight.* A pilot shall not pilot an aircraft under instrument flight rules unless he has had at least 6 hours of instrument flight under actual or simulated flight conditions during the preceding six calendar months or until he has had 6 hours of such flight time under:

(1) Actual instrument conditions, accompanied by a pilot of at least private rating holding an appropriate aircraft and instrument rating, or

(2) Simulated instrument conditions in an aircraft accompanied by a pilot of at least private rating holding an appropriate aircraft rating, or

(3) Simulated instrument conditions in equipment approved by the Adminis-

[1] Annex 1 to the Convention on International Civil Aviation (Personnel Licensing Standards) requires a pilot to have a type rating for all aircraft of a maximum certificated take-off weight of over 12,500 lbs. However, by the terms of the Convention, a holder of a pilot certificate issued prior to May 1, 1949, may, until May 1, 1953, exercise all of the privileges of such certificate both in the United States and internationally without compliance with the international standards.

[2] Annex 1 in defining the privileges of a commercial pilot restricts such pilot to the piloting in international air transportation of aircraft of 12,500 lbs. or less maximum certificated take-off weight. However, by the terms of the Convention, this restriction is not applicable until May 1, 1953, to certificates issued prior to May 1, 1949.

trator, except that at least 3 hours must have been had in accordance with subparagraphs (1) or (2) of this paragraph.

[Amdt. 43-0, 10 F. R. 5062, 5063, as amended by Amdt. 43-5, 14 F. R. 2198]

DEFINITIONS

§ 43.70 *Definitions.* (a) "Pilot" is a person holding a valid pilot certificate issued by the Administrator.

(b) "To pilot" means to be in command of the aircraft during take-off, in flight, or landing.

(c) "Passenger" is an occupant of the aircraft in flight other than a crew member.

(d) "Flight instructor" means a private or commercial pilot who possesses a valid flight instructor rating.

(e) "Routine maintenance" is defined as simple or minor preservation operations, including but not limited to the adjustment of rigging and clearances, and the replacement of small standard parts not involving complex assembly operations.

(f) *Category.* Category shall indicate a classification of aircraft such as airplane, helicopter, glider, etc.

(g) *Class.* Class shall indicate a difference in basic design of aircraft within a category, such as single-engine land, multiengine sea, etc.

(h) *Copilot.* Copilot shall mean a pilot serving in any piloting capacity other than as pilot in command on aircraft requiring two pilots for normal operations, but excluding a pilot who is on board the aircraft for the sole purpose of receiving dual instruction.

(i) *Dual instruction time.* Dual instruction time shall mean that portion of the flight time during which a person is receiving flight instruction from a rated flight instructor on board the aircraft.

(j) *Flight instructor.* Flight instructor means a pilot who is qualified to instruct other pilots and who has received a flight instructor rating.

(k) *Flight time.* Flight time shall mean the total time from the moment the aircraft first moves under its own power for the purpose of flight until the moment it comes to rest at the end of the flight.[3]

(l) *Pilot in command.* Pilot in command shall mean the pilot responsible for the operation and safety of the aircraft during the time defined as flight time.

(m) *Solo flight time.* Solo flight time shall mean the flight time during which a pilot is the sole occupant of an aircraft.

(n) *Type.* Type shall mean all aircraft of the same basic design including all modifications thereto except those modifications which result in a change in handling or flight characteristics.

[Amdt. 43-0, 10 F. R. 5062, 5063, as amended by Amdt. 43-5, 14 F. R. 2198]

[3] For example, a pilot taxies to the warm-up apron and holds there for several minutes before taking off to permit the engine to warm up. Such taxi and warm-up time is not considered flight time. Flight time begins when the aircraft leaves the warm-up apron and ends when the pilot returns to parking apron and turns the switches off.

PART 44—FOREIGN AIR CARRIER REGULATIONS

AUTHORITY: §§ 44.0 to 44.7 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 601, 610, 52 Stat. 1007, 1016; 49 U. S. C. 551, 560]

SOURCE: §§ 44.0 to 44.7 contained in Amendment 44-0, 10 F. R. 6366, except as noted following section affected.

§ 44.0 *General.* The regulations in this part shall apply to scheduled operations within the United States by aircraft of a foreign air carrier holding a permit issued by the Board pursuant to the provisions of section 402 of the Civil Aeronautics Act of 1938.

§ 44.1 *Definitions.* (a) As used in this part the words listed below shall be defined as follows:

(1) *Category.* Category shall indicate a classification of aircraft such as airplane, helicopter, glider, etc.

(2) *Type.* Type shall mean all aircraft of the same basic design including all modifications thereto except those modifications which result in a change in handling or flight characteristics.

(3) *United States.* United States shall mean the continental United States and any outlying Territories under its jurisdiction (including the Canal Zone).

[Amdt. 44-1, 14 F. R. 2198]

§ 44.2 *Operations specifications.* All operations within the United States shall be conducted in accordance with operations specifications issued by the Administrator of Civil Aeronautics which shall include the airports to be used, the routes or airways to be flown, and such operating rules and practices pertaining thereto as are necessary in the interest of avoiding collision between foreign aircraft and other aircraft.

§ 44.3 *Aircraft airworthiness.* Each air carrier aircraft shall be possessed of a currently effective certificate of airworthiness issued by the country whose nationality it possesses. The air carrier shall not operate any airplane within the United States at weights in excess of the maximum weights authorized by the country of origin of the airplane type involved.

[Amdt. 44-1, 12 F. R. 950, as amended by Amdt. 44-1, 14 F. R. 2198]

§ 44.4 *Radio equipment.* The air carrier shall, subject to compliance with the applicable laws and regulations governing the ownership and operation of radio equipment, provide each aircraft with such radio equipment as is necessary to make proper use of the air navigation facilities along or adjacent to the route to be flown within the United States and to maintain communication with ground stations along and adjacent to such routes.

§ 44.5 *Flight crew certificates.* Each member of the flight crew shall be possessed of a currently effective certificate or license issued by the country whose nationality the aircraft possesses, evidencing competency to perform his duties in connection with the operation of such aircraft.

§ 44.6 *Air traffic rules and procedures.* All operations within the United States shall be conducted in accordance with the air traffic rules prescribed in Part 60 of this subchapter and with such local rules as are established at the airports to be used. Each pilot assigned to serve in such operations shall be familiar with the pertinent rules, with the navigational and communication facilities to be used, and with the air traffic controls and other procedures employed in the areas to be traversed. Each air carrier shall establish procedures to insure the possession of such knowledge by its pilots and shall check the ability of each pilot to operate safely in accordance with the applicable rules and procedures. Each foreign air carrier shall conform to the same practices, procedures, and other requirements for the use of the areas to be traversed as are prescribed by the Administrator of Civil Aeronautics for domestic air carriers using such areas.

§ 44.7 *Control of traffic.* The air carrier shall, subject to compliance with immigration laws and regulations, furnish the ground personnel necessary to provide for two-way voice communication between the aircraft and ground stations at such places as the Administrator of Civil Aeronautics finds voice communication necessary, if communication cannot be maintained in a language with which ground station operators are familiar. Such personnel shall be able to speak both the English language and the language necessary to maintain communication with the aircraft and shall assist ground personnel of the United States in directing traffic. These requirements shall not be applicable in cases where the Administrator of Civil Aeronautics finds that such traffic can be adequately controlled by the use of radiotelegraphy or other means.

PART 45—COMMERCIAL OPERATOR CERTIFICATION AND OPERATION RULES

AUTHORITY: §§ 45.1 to 45.5 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 601, 607, 52 Stat. 1007, 1011; 49 U. S. C. 551, 557.

SOURCE: §§ 45.1 to 45.5 appear at 14 F. R. 1437.

§ 45.1 *Applicability of part.* The provisions of this part shall be applicable to citizens of the United States engaging in the carriage in air commerce of goods or passengers for compensation or hire, unless such carriage is conducted under the provisions of an air carrier operating certificate issued by the Administrator. For the purpose of this part, student instruction, banner towing, crop dusting, seeding, and similar operations shall not be considered as the carriage of goods or persons for compensation or hire.[1]

§ 45.2 *Certificate required.* No person subject to the provisions of this part shall engage in air commerce using aircraft of 12,500 lbs. or more certificated maximum take-off weight until he has obtained from the Administrator a commercial operator certificate: *Provided,* That any such person may engage in operations subject to the provisions of this part without a commercial operator certificate until such time as the Administrator shall pass on his application for such certificate, but in no case later than January 1, 1950, if he (a) is engaged in such operations on the date of adoption of this part and (b) has filed with the Administrator an application for such certificate not later than June 1, 1949.

§ 45.3 *Certification requirements.* A commercial operator certificate shall be issued to an applicant who is capable of conducting his operations in accordance with the requirements of Part 42 of this chapter as heretofore or hereafter amended, or at an equivalent level of safety.

§ 45.4 *Operating rules.* All persons subject to the provisions of this part shall comply with the operating requirements of Part 42 of this chapter, as heretofore or hereafter amended, except that no person shall be required to comply with the provisions of § 42.12, fire prevention requirements, until January 1, 1950. Operating requirements shall be deemed to include requirements relating to aircraft and equipment, maintenance, flight crew, flight time limitations, flight operation, aircraft operating limitations, and related record-keeping and reporting requirements.

§ 45.5 *Certificate rules.* The certificate rules prescribed in §§ 42.5 through 42.9 of this chapter shall be applicable to commercial operator certificates.

PART 48—OPERATION OF MOORED BALLOONS

AUTHORITY: §§ 48.1 to 48.5 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply sec. 601, 52 Stat. 1007; 49 U. S. C. 551.

SOURCE: §§ 48.1 to 48.5 contained in Amendment 48-0, Civil Air Regulations, 12 F. R. 5910.

§ 48.1 *Scope.* The following regulations in this part shall apply to moored balloons having a diameter of more than 6 feet or a gas capacity of more than 115 cubic feet when operated anywhere in the United States, including the several States, the District of Columbia, and the several Territories and possessions of the United States, including the territorial waters and the overlying airspace thereof.

§ 48.2 *General.* Moored balloons having a diameter of more than 6 feet or a gas capacity of more than 115 cubic feet may be operated without permit from or notice to the Administrator when operated less than 150 feet above the surface at a location more than 5 miles from the boundary of an airport. Balloons of smaller size than specified in this section are exempt from compliance with the regulations in this subchapter.

§ 48.3 *Operation requiring permit.* Unless operated under the conditions specified in § 48.2 moored balloons subject to the regulations in this part shall be operated under the authority of and in compliance with the terms and conditions of a permit issued by the Administrator when such moored balloons are operated:

(a) Closer than 500 feet to the base of any cloud, or
(b) During the hours of darkness, or
(c) When ground visibility is less than 3 miles, or
(d) At altitudes more than 500 feet above the surface, or
(e) Within 5 miles of the boundary of an airport.

§ 48.4 *Operation requiring notice.* Unless operated under the conditions specified in §§ 48.2 or 48.3, written notice must be submitted to the nearest office of the Civil Aeronautics Administration at least 30 days prior to the date of operation when moored balloons subject to the regulations in this part are operated between 150 and 500 feet above the surface. Such notice shall contain the name and address of the owner and person operating the balloon, the date or dates of the proposed operation, and the location and altitude at which the proposed operation will be conducted.

§ 48.5 *Rapid deflation device.* No moored balloon having a diameter of more than 6 feet or a gas capacity of more than 115 cubic feet shall be operated unless it is equipped with a device or means of automatic and rapid deflation in the event of an escape from its moorings.

PART 49—TRANSPORTATION OF EXPLOSIVES AND OTHER DANGEROUS ARTICLES

AUTHORITY: §§ 49.0 to 49.81 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply sec. 601, 52 Stat. 1007; 49 U. S. C. 551.

SOURCE: §§ 49.0 to 49.81, effective July 20, 1949, appear at 14 F. R. 2787.

§ 49.0 *Applicability of part.* Explosives or other dangerous articles, including flammable liquids, flammable solids, oxidizing materials, corrosive liquids, compressed gases, and poisonous substances, shall not be loaded in or transported by civil aircraft in the United States, or transported anywhere in air commerce in civil aircraft of United States registry except as hereinafter provided.

§ 49.1 *Definitions.* (a) As used in this part the words listed below shall be defined as follows:

(1) *Explosives.* Those liquids, gases, or solids specified as "Forbidden Explosives," Class A, Class B, or Class C explosives by the ICC Regulations.

(2) *Flammable[1] liquid.* A flammable liquid is any liquid which gives off flammable vapors (as determined by flash point from Tagliabue's open-cup tester, as used for test of burning oils) at or below a temperature of 80° F.

(3) *Flammable solid.* A flammable solid is a solid substance, other than one classified as an explosive, which is likely under conditions incident to transportation, to cause fires through friction, through absorption of moisture, through spontaneous chemical changes, or as a result of retained heat from the manufacturing or processing.

(4) *Oxidizing material.* An oxidizing material is a substance such as a chlorate, permanganate, peroxide, or a nitrate, that yields oxygen readily to stimulate the combustion of organic matter.

(5) *Corrosive liquids.* Corrosive liquids are those acids, alkaline caustic liquids, and other corrosive liquids which, when in contact with living tissue, will cause severe damage to such tissue by chemical action, or which, in case of leakage, will materially damage the air-

[1] Under circumstances where it is doubtful whether the operations are for "compensation or hire," the test to be applied is whether the air carriage is merely incidental to the operator's other business or is, in and of itself, a major enterprise for profit.

[1] Chapter 39, "Explosives and Combustibles," of Title 18 of the U. S. Code, Public Law 772, 80th Congress, 2d Sess.; 18 U. S. C. 831 et seq., enacted June 25, 1948, which supersedes the Transportation of Explosives Act of March 4, 1921, adopts the term "flammable" in place of the currently-used term "inflammable." As used in this part "flammable" has the same meaning as "inflammable" and "nonflammable" the same meaning as "noninflammable" as used by current ICC Regulations.

craft structure or cargo; or which are likely to cause fire when in contact with organic matter or with certain chemicals.

(6) *Compressed gas.* A compressed gas for the purposes of these regulations is defined as any material or mixture having in the container either an absolute pressure exceeding 40 pounds per square inch at 70° F., or an absolute pressure exceeding 104 pounds per square inch at 130° F., or both; or any liquid flammable material having a Reid[3] vapor pressure exceeding 40 pounds per square inch absolute at 100° F. (See § 49.1 (a) (7) (i) for gases defined and classified as poisonous.)

(i) Any compressed gas, as defined above, shall be classified as a flammable compressed gas if either (*a*) a mixture of 13 percent or less (by volume) with air forms a flammable mixture or (*b*) the flammability range with air is greater than 12 percent regardless of the lower limit.

(7) *Poisonous articles.* Poisonous articles for the purpose of these regulations are divided into four classes defined as follows:

(i) *Extremely dangerous poisons; Class A.* Poisonous gases or liquids of such nature that a very small amount of gas, or vapor of the liquid, mixed with air is dangerous to life. This class includes: chlorpicrin, cyanogen, diphosgene, ethyldichlorarsine, hydrocyanic acid, lewisite, methyldichlorarsine, mustard gas, nitrogen peroxide (tetroxide), phenylcarbylamine chloride, phosgene (diphosgene). (Dilute solutions of hydrocyanic acid of not exceeding 5 percent strength are classed as poisonous articles, Class B.)

(ii) *Less dangerous poisons; Class B.* Poisonous liquids and solids, including pastes and semisolids, are substances of such nature that they are chiefly dangerous by external contact with the body or by their being taken internally as in contaminated food or feeds.

(iii) *Tear gas or irritating substances; Class C.* Tear gases are liquid or solid substances which upon contact with fire or when exposed to air give off dangerous or intensely irritating fumes, such as brombenzylcyanide, chloracetophenone, diphenylaminechlorarsine, and diphenylchlorarsine, but not including any poisonous article, Class A.

(iv) *Radioactive materials; Class D.* A radioactive material is any material or combination of materials with spontaneously emits ionizing radiation. For the purpose of these rules, radioactive materials are divided into three groups, according to the type of radiation emitted at any time during transportation, as follows:

(*a*) *Group I radioactive materials.* Group I radioactive materials are those materials which emit any gamma radiation, either alone or with electrically charged particles or corpuscles.

(*b*) *Group II radioactive materials.* Group II radioactive materials are those materials which emit neutrons and either or both of the types of radiation characteristic of Group I radioactive materials.

(*c*) *Group III radioactive materials.* Group III radioactive materials are those materials which emit only electrically charged particles or corpuscles (i. e., alpha and/or beta radiation).

(8) *"Unit" of gamma radiation.* "Unit" of gamma radiation is one milliroentgen per hour at a meter for "hard gamma" radiation, i. e., that amount of gamma radiation which will have the same effect on sensitive photographic film as one milliroentgen per hour at a meter of "hard gamma" radiation of radium filtered through ½ inch of lead.

(9) *Passenger-carrying aircraft.* A passenger-carrying aircraft is an aircraft carrying any individual other than a flight crew or crew member, company employee, or an authorized government representative.

(10) *Cargo aircraft.* A cargo aircraft is an aircraft other than a passenger-carrying aircraft which is carrying goods or property.

(11) *Marking.* Marking is the display on the container of the name of the articles inside, as listed in the commodity list of the ICC Regulations.

(12) *Labeling.* Labeling is the display on the container of an appropriate label as specified for a particular class of articles by the ICC Regulations.

(13) *ICC Regulations.* ICC Regulations shall mean the "Interstate Commerce Commission's Regulations for Transportation of Explosives and Other Dangerous Articles," effective January 7, 1941, as amended or revised from time to time[3] (49 CFR, Parts 71-77).

(14) *Aircraft operator.* An operator of aircraft shall include the owner, lessee, or any other person who causes or authorizes the operation of the aircraft.

§ 49.3 *Packing, marking, and labeling requirements.* (a) Unless otherwise specifically provided in this part, explosives or other dangerous articles shipped by air shall be packed, marked, and labeled in accordance with the specifications established in Part 72[4] of the ICC Regulations for transportation by rail express: *Provided,* That liquids shall be packed only in containers which are securely closed, sufficient in strength to prevent any leakage or distortion of the containers caused by change in temperature or altitude during transit, and so filled as to provide adequate outage. All explosives or other dangerous articles shipped by air shall show the proper shipping name as shown in the commodity list of Part 72 of the ICC Regulations and any instructions that are necessary for safe handling.

(b) No shipper shall offer and no air carrier or other operator of aircraft shall knowingly accept explosives or dangerous articles for carriage by air unless the shipper or his authorized agent has certified that the shipment complies with the requirements of this part. No shipment shall be accepted for transportation by passenger-carrying aircraft unless the package shows a clear and plainly visible statement that it is within the limitations prescribed for passenger operations. Any operator of aircraft may rely on such a certificate as prima facie evidence that the shipment so certified complies with the requirements of this part.[5]

PASSENGER-CARRYING AIRCRAFT

§ 49.10 *Acceptable explosives and other dangerous articles on aircraft carrying passengers.* No article listed in Appendices A or B of this part shall be carried on passenger-carrying aircraft, and no other explosive or dangerous article shall be carried in passenger-carrying aircraft except as provided in §§ 49.11 through 49.18.

§ 49.11 *Explosives.* Class C explosives may be carried. Class C explosives shall be packed, marked, and labeled as required by Part 72 of the ICC Regulations. The maximum quantity that may be packed in one outside container is 50 pounds.

§ 49.12 *Flammable liquids.* Flammable liquids may be carried when packed in quantities of not more than one quart in inside metal containers or in quantities of not more than one pint in inside glass or earthenware containers. Each inside container shall be packed in a strong outside container with cushioning and absorbent material where necessary to prevent breakage and leakage: *Provided,* That viscous flammable liquids, such as cement mastics and sealers, may also be carried in quantities of not more than 8 fluid ounces in collapsible tubes which are packed in quantities of not more than 16 fluid ounces in any one strong outside container.

§ 49.13 *Flammable solids and oxidizing materials.* (a) Except for the items listed in subparagraphs (1) through (6) of this paragraph which shall be specially handled as provided therein, flammable solids and oxidizing materials may be carried in quantities of not more than 16 ounces net weight in inside metal or glass containers, suitably cushioned with nonflammable material where necessary to prevent breakage or leakage and

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[2] American Society for Testing Materials Method of Test for Vapor Pressure of Petroleum Products (D-323).

[3] The regulations referred to may be obtained from the Government Printing Office, Washington 25, D. C., or from the Bureau of Explosives, 30 Vesey Street, New York 7, N. Y.

[4] Part 72 of the ICC Regulations incorporates the packaging specifications of Part 73 thereof. It will be noted that items exempted from the packaging, labeling, or marking provisions of Part 73 of the ICC Regulations are not exempted from such requirements for shipment by air unless it is expressly so provided in this part.

[5] The following statement on a shipping label signed by a responsible agent of the shipper will be accepted as meeting this requirement: "This is to certify that the contents of this package are properly described by name and are packed and marked and are in proper condition for transportation according to the regulations prescribed by the Interstate Commerce Commission and the Civil Aeronautics Board."

For shipment on passenger-carrying aircraft add the following: "This shipment is within the limitations prescribed for passenger-carrying aircraft."

packed in strong outside containers. The maximum quantity that may be packed in any outside container is 25 pounds.

(1) *Liquid or solid organic peroxides.* Liquid or solid organic peroxides shall be packed in inside containers of not over one pound or one pint capacity. Not more than one such inside container suitably cushioned with nonflammable material shall be packed in a strong outside container. (See corrosive liquids for hydrogen peroxide.)

(2) *Calcium hypochlorite, dry.* Calcium hypochlorite, dry, containing more than 8.80% available oxygen (39% available chlorine) shall be packed in inside glass or metal containers of not over 5-pound capacity. Each container shall be packed in strong outside containers.

(3) *Matches.* Strike-on-box, book, or card-type matches shall be packed in tightly closed metal inside containers. The maximum quantity of matches that may be packed in any outside container is 25 pounds.

(4) *Picrate of ammonia, picric acid, urea nitrate, trinitrobenzene, and trinitrotoluene.* Picrate of ammonia, picric acid, urea nitrate, trinitrobenzene, or trinitrotoluene, wet with not less than 10% water, may be carried only when shipped as a drug, medicine, or chemical, and shall be packed in a glass container enclosed in a strong fiber carton properly cushioned with nonflammable material in an outside shipping case provided that not more than 16 ounces net content shall be packed in any one outside container.

(5) *Pyroxylin plastics.* Pyroxylin (nitrocellulose) plastics shall be securely enclosed in tight inside metal containers packed in quantities of not more than 25 pounds in strong outside containers.

(6) *Motion picture film.* Motion picture film (nitrocellulose base) shall be packed, marked, and labeled in accordance with the requirements of Part 72 of the ICC Regulations.

§ 49.14 *Acids and other corrosive liquids.* (a) Acids and other corrosive liquids may be carried when packed in bottles of not more than one pint capacity, suitably cushioned with nonflammable material to prevent breakage or leakage, and packed in a metal can. Each can shall be packed in a strong outside container.

(b) Electric storage batteries containing electrolyte or corrosive battery fluid, of the nonspillable type, protected against short circuits, and completely and securely boxed, may be carried.

§ 49.15 *Nonflammable compressed gases.* Nonflammable compressed gases may be carried. Shipment shall be made in ICC approved cylinders, and pressures shall not exceed those permitted by the ICC.

§ 49.16 *Poisonous liquids.* Class B poisonous liquids may be carried in quantities of not more than one pint in glass containers, suitably cushioned to prevent breakage or leakage, or not more than one quart in inside metal containers. Each inside container shall be packed in a strong outside wooden or fiberboard box.

§ 49.17 *Poisonous solids.* Class B poisonous solids may be carried:

(a) Except for cyanides which shall be packed as set forth below, Class B poisonous solids shall be packed in tightly closed inside containers of glass, earthenware, or metal, or in lock-corner sliding-lid wooden boxes lined to prevent sifting, of not more than 5 pounds capacity each. Inside containers shall be securely packed in outside fiberboard or wooden containers. Not more than 25 pounds of any such article shall be packed in any one outside container.

(b) Cyanides and cyanide mixtures shall be packed in a tightly closed glass, earthenware, or metal inside container, of not over one pound capacity, securely cushioned and packed in quantities of not more than 5 pounds in outside wooden or fiberboard boxes or in wooden barrels.

§ 49.18 *Radioactive materials.* Radioactive materials—Class D, Groups I, II, and III (liquid, solid, or gaseous) may be carried when packed, marked, and labeled in accordance with the provisions of §§ 73.368 through 73.369 of the ICC Regulations. (See § 49.55 for handling of radioactive materials in aircraft. See also § 49.62 where certain other types of radioactive materials are exempted from certain of the requirements of this part.)

CARGO AIRCRAFT

§ 49.41 *Articles which may be carried in cargo aircraft.* In addition to the articles acceptable for transportation on aircraft carrying passengers, any article acceptable for and packed, marked, and labeled in accordance with the ICC Regulations for transportation by rail express may be carried in cargo aircraft: *Provided,* That no article listed in Appendix A of this part shall be carried except under the provisions of § 49.71. The maximum quantity in any one outside package or container shall not exceed that prescribed in the commodity list of Part 72 of the ICC Regulations.

LOADING AND HANDLING REQUIREMENTS

§ 49.51 *Cargo location.* (a) Articles subject to the requirements of this part shall not be carried in the cabins of passenger-carrying aircraft.

(b) Any article acceptable only for cargo aircraft shall be carried in accessible cargo pits or bins or in the cabin.

(c) Articles shall not be placed in the same cargo pit or bin nor placed side by side in cabins so that:

(1) Yellow label material is mixed with either white label or with red label material, or

(2) White label material is mixed with poison label material (red printing on white background).

§ 49.52 *Pilot notification.* When articles subject to the packing, marking, and labeling requirements of this part are carried on aircraft, the operator shall be responsible for notifying the pilot of the proper shipping name of the article as shown in the commodity list of Part 72 of the ICC Regulations, the type of label, quantity, and the location thereof. The pilot notification requirement may be met by entering the required information on the airplane load manifest.

§ 49.53 *Damaged or improperly marked articles.* If any package coming under the provisions of this part appears to be damaged, leaking, or improperly marked and labeled, it shall be removed from the aircraft and shall not be returned to transportation by air until it has been determined that the package and its contents comply with the requirements of this part.

(a) In any instance where it is indicated that the requirements of this part have been violated, a report shall immediately be made to the nearest representative of the Administrator or Board.

§ 49.54 *Quantity limitations.* Except as provided below not more than 50 pounds net weight of any article subject to the packing and labeling provisions of this part may be carried in any one cargo pit or bin on passenger-carrying aircraft, or in any inaccessible cargo pit or bin on any aircraft:

(a) Not more than 150 pounds net weight of compressed nonflammable gas may be carried in any single cargo pit or bin on passenger-carrying aircraft or in any inaccessible cargo pit or bin in any aircraft.

(b) No quantity limit is prescribed for calcium hypochlorite, pyroxylin plastics, motion picture film, or radioactive material Group III.

(c) Not more than 40 units of radioactive material Groups I or II shall be carried on any aircraft.

(d) Except as provided above for inaccessible cargo pits or bins, no quantity limitations apply to the carriage of explosives or other dangerous articles under the provisions of this part in cargo aircraft.

§ 49.55 *Special requirements for radioactive materials.* (a) Whenever any shipment of radioactive materials is damaged or appears to be damaged, it shall be removed from transportation and segregated as far as possible from human contact. The shipper shall immediately be contacted for disposal instructions, and the Administrator or the Board shall also be notified.

(b) Whenever there is any actual spillage of radioactive materias of such nature that the materials are no longer contained within their inner containers, no attempt shall be made to remove or clean up the materials until instructions are received from the shipper or other qualified persons, and then only when necessary protective measures have been taken, and qualified persons are present to supervise the handling.

(c) A container or group of containers of radioactive materials shall not be placed closer than the distance specified in the distance table to any area that may be continuously occupied by crew members or passengers. If more than one such container is present the distance shall be computed from the table below by adding together the number of units shown on the label of each package.

TABLE FOR PERSONNEL SEPARATION [1]

Total number of units: [2]	Minimum distance to crew members and passengers (feet) [3]
0-2	1
3-5	2
6-10	3
11-20	4
21-30	5
31-40	6

[1] This table is designed to afford maximum protection to human beings from the effects of radiation and will not protect X-ray film from such effects under all conditions of exposure. Distance separation required by this table for Groups I and II (red label) radioactive materials is not required for Group III (blue label) radioactive materials.

[2] Total number of units refers to the number found on the red label of a single package entered on the line reading, "Radiation Units from Package: No. ." For two or more packages stored together, the total of the numbers of all such packages is meant.

[3] Distance means the number of feet from the nearest edge of the nearest radioactive container.

(d) If any aircraft is engaged principally or entirely in the transportation of radioactive materials, it shall be the responsibility jointly of the shipper and the carrier to monitor all personnel involved so that the accepted limits of personnel radiation exposure are not exceeded.

EXEMPTED ARTICLES

§ 49.61 *Aircraft equipment.* Signalling devices, aviation fuel and oil carried in tanks complying with fuel and oil tank installation provisions of this subchapter, and other equipment and materials necessary for the safe operation of the aircraft on which they are carried shall be exempt from the provisions of this part.

§ 49.62 *Radioactive materials.* (a) Radioactive materials which meet all of the following conditions are exempt from packing, marking, and labeling requirements required by this part:

(1) The package shall be such that there can be no leakage of radioactive material under conditions normally incident to transportation.

(2) The package shall contain not more than 0.1 millicuries of radium, or polonium, or that amount of strontium 89, strontium 90, or barium 140 which disintegrates at a rate of more than 5 million atoms per second; or not more than that amount of any other radioactive substance which disintegrates at a rate of more than 50 million atoms per second.

(3) The package shall be such that no significant alpha, beta, or neutron radiation is emitted from the exterior of the package, and the gamma radiation at any surface of the package shall be less than 10 milliroentgens in 24 hours.

(b) Manufactured articles other than liquids, such as instrument or clock dials of which radioactive materials are a component part, and luminous compounds, when securely packed in strong outside containers are exempt from packing, marking, and labeling requirements, provided the gamma radiation at any surface of the package is less than 10 milliroentgens in 24 hours.

(c) (1) Radioactive materials such as ores, residues, etc., packed in strong, tight containers are exempt from packing and labeling requirements for shipment in planeload lots, provided the per planeload radiation intensity at one meter from any outside surface of the load (as loaded in place in the airplane) does not exceed 10 milliroentgens per hour of gamma radiation or equivalent. There shall be no loose radioactive material in the airplane, and the shipment must be braced and lashed so as to prevent leakage or shift of lading under normal conditions of flight.

(2) It is the responsibility of the consignor and/or consignee to supervise, respectively, all loading and unloading operations and to monitor all personnel involved so that the accepted limits of personnel radiation exposure are not exceeded.

(d) Shipments of radioactive materials made by the Atomic Energy Commission or under its direction or supervision, which are escorted by personnel who are specially designated by the Atomic Energy Commission, are exempted from the provisions of these regulations where special arrangements are made with and approval by the Administrator.

§ 49.63 *Additional exempted articles.* The following articles are exempted from the provisions of this part.

(a) *Small arms ammunition.* Small arms ammunition in small quantities for personal use.

(b) *Matches.* Small quantities of matches, of the strike-on-box, book, or card type, carried on the person.

(c) *Pyroxylin plastics.* Articles manufactured from a pyroxylin plastic base such as hairbrushes, combs, and toothbrushes which are exempted from the requirements of the ICC Regulations.

(d) *Safety film.* Film having an acetate base.

§ 49.71 *Special authority.* In emergency situations or where other forms of transportation are impracticable, deviations from any of the provisions of this part for a particular flight may be authorized by the Administrator where he finds that the conditions under which the articles are to be carried are such as to permit the safe carriage of persons and cargo.

§ 49.81 *Prohibited articles.* No explosive or dangerous article listed in Part 72 of the ICC Regulations as an Explosive A, a Poison A, a forbidden article, or as an article not acceptable for rail express (see § 49.62 for authorization of the carriage of certain radioactive materials), nor any article listed in Appendix A shall be carried on aircraft subject to the provisions of this part.

APPENDIX A—ITEMS PROHIBITED FROM TRANSPORTATION BY AIR

EXPLOSIVES

Ammunition for cannon.
Blasting caps, including electric blasting caps.
Blasting caps with safety fuse.
Jet thrust units.
Rocket ammunition.

FLAMMABLE LIQUIDS

Acrolein.
Carbon bisulfide (disulfide).
Nickel carbonyl.
Zinc ethyl.

FLAMMABLE SOLIDS AND OXIDIZING MATERIALS

Acetyl benzoyl peroxide, solid.
Acetyl peroxide, solid.
Burnt cotton (not repicked).
Burnt fiber.
Carbopropoxide stabilized or unstabilized.
Charcoal, wood, screenings, other than "pinon" wood screenings.
Cotton waste, oily, with more than 5% animal or vegetable oil.
Fish scrap or fish meal containing less than 6% or more than 12% moisture.
Garbage tankage containing less than 8% moisture.
Hair, wet.
Iron mass, spent.
Iron sponge not properly oxidized.
Iron sponge, spent.
Matches, strike-anywhere.
Motion picture film scrap (nitrocellulose).
Paper stock, wet.
Rags, oily.
Rags, wet.
Spent oxide.
Tankage, fertilizers.
Tankages, rough ammoniate.
Textile waste, wet
Waste paper, wet.
X-ray film scrap (nitrocellulose base).

COMPRESSED FLAMMABLE GAS

Fluorine.

APPENDIX B—ITEMS PROHIBITED FROM TRANSPORTATION BY AIR ON PASSENGER-CARRYING AIRCRAFT

EXPLOSIVES

Explosives Class B, all.
Chemical Ammunition containing Class B or Class C poisons.

FLAMMABLE LIQUIDS

Ethyl chloride.
Ethyl trichlorosilane.
Ethylene oxide.
Lithium aluminum hydride ethereal.
Spirits of nitroglycerin in excess of one (1) percent by weight.
Trichlorosilane.

FLAMMABLE SOLIDS AND OXIDIZING MATERIALS

Acetyl benzoyl peroxide solution.
Bags, nitrate of soda, empty and unwashed.
Benzoyl peroxide.
Calcium chlorite.
Calcium phosphide.
Calcium resinate.
Calcium resinate, fused
Chlorobenzoyl peroxide (para).
Cobalt resinate, precipitated.
Lithium hydride.
Lithium metal (unless exempt from ICC Regulations).
Lithium silicon.
Peracetic acid.
Phosphoric anhydride.
Phosphorous, amorphous, red.
Phosphorous pentachloride.
Phosphorous, white or yellow.
Phosphorous sesquisulfide.
Photographic film scrap (processed, positive or, negative nitrocellulose).
Picric acid, wet, exceeding 16 ounces by weight.
Potassium, metallic and potassium metallic liquid alloy.
Potassium peroxide.
Pyroxylin plastic scrap.
Sodium chlorite.
Sodium metallic and sodium metallic liquid alloy.
Sodium peroxide.
Sodium picramate.
Thorium metal, powdered.
Titanium metal, powdered.
Zirconium, metallic, dry, wet or sludge.

ACIDS AND OTHER CORROSIVE LIQUIDS

Acid sludge.
Allyl chloroformate.
Amil trichlorosilane.
Antimony pentafluoride.
Benzoyl bromide.
Benzoyl chloroformate.
Bromine.
Bromine trifluoride.
Bromo toluene.
Chloracetyl chloride.
Chlorine trifluoride.
Diethyl dichlorosilane.
Dimethyl sulphate.
Diphenyl dichlorosilane.
Difluorophosphoric acid, anhydrous.
Electrolyte or alkaline battery fluid packed with storage batteries, battery chargers, or radio current supply devices.
Ethylphenyl dichlorosilane.
Ethyl chlorofomate.
Ethyl formate.
Fluosulfonic acid.
Hexafluorophosphoric acid.
Hexyl trichlorosilane.
Hydrazine, anhydrous.
Hydrazine solution containing 50% or less of water.
Hydrofluoric acid, anhydrous.
Hypochlorite solution more than 7% chlorine by weight.
Methyl chloroformate.
Mixtures of hydrofluoric and sulphuric acids.
Monofluorophosphoric acid, anhydrous.
Nitrating (mixed) acid.
Nitric acid.
Nitrohydrochloric acid.
Nitrohydrochloric acid, and dilute.
Octyl trichlorosilane.
Phenylphosphorous oxychloride.
Phosphorous tribromide.
Phosphorous trichloride
Propyl trichlorosilane.
Spent acid, sulfuric or mixed.
Sulfur chloride.
Thionyl chloride.
Thiophosphoryl chloride.

COMPRESSED GASES

All flammable gases.
Nonflammable gases as follows:
Anhydrous ammonia.
Boron trifluoride.
Chlorine.
Hydrogen bromide.
Hydrogen chloride.
Nitrosyl chloride.
Sulfur dioxide.

POISONOUS ARTICLES

Aniline oil.
Chemical ammunition.
Hydrocyanic acid solutions.
Methyl bromide.
Motor fuel antiknock compound.
Phenyldichlorarsine.
Tetraethyl lead.

PART 50—AIRMAN AGENCY CERTIFICATES

No. 136——40

AUTHORITY: §§ 50.1 to 50.33 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply sec. 601, 52 Stat. 1007; 49 U. S. C. 551.

SOURCE: §§ 50.1 to 50.33 contained in Civil Air Regulations, Amendment 50-0, 11 F. R. 4912.

CERTIFICATE

§ 50.1 *Issuance.* An airman agency certificate will be issued to an applicant who complies with the minimum requirements for one or more school ratings.

§ 50.2 *School ratings.* (a) Basic ground school.
(b) Advanced ground school.
(c) Primary flying school.
(d) Commercial flying school.
(e) Instrument flying school.
(f) Flight instructor school.

REQUIREMENTS

§ 50.10 *Ground school requirements.* (a) Classrooms adequately heated and lighted, of sufficient size to accommodate the greatest number of students scheduled for attendance at any one time.

(b) Sufficient classroom equipment to insure adequate instruction in all required subjects.

(c) At least one regularly available principal instructor possessed of a ground instructor certificate with ratings for each of the required subjects of the curriculum.

§ 50.11 *Ground school curriculum.* A ground school curriculum approved by the Administrator for at least one of the following:

(a) *Basic ground school.* 50 hours of classroom instruction in the subjects of Civil Air Regulations (the regulations in this subchapter), including air traffic control practices and procedures, navigation, meteorology, and general servicing of aircraft.

(b) *Advanced ground school.* 100 hours of instruction in the subjects of Civil Air Regulations, including air traffic control practices and procedures, navigation, meteorology, aircraft and engines, including the general servicing and maintenance of aircraft and engines.

§ 50.12 *Flying school requirements.* (a) An airport adequate for the aircraft to be used and safe for the flight instruction to be given.

(b) Adequate hangar facilities housing all aircraft used for flight instruction.

(c) Adequate office, rest room, and ready room facilities.

(d) A sufficient number of certificated aircraft appropriate for the flight instruction to be given.

(e) Adequate shop, or readily available facilities suitable to insure proper maintenance of the aircraft to be used.

(f) A sufficient number of certificated mechanics readily available to provide for the inspection, maintenance, and repair of all aircraft used for flight instruction, unless other arrangements are approved by the Administrator.

(g) A sufficient number of regularly available and appropriately rated flight instructors.

§ 50.13 *Flying school curriculum.* A curriculum approved by the Administrator for at least one of the following:

(a) *Primary flying school.* 35 hours flying, or, if nonspinnable aircraft are used, not less than 25 hours flying.

(b) *Commercial flying school.* 160 hours of flying.

(c) *Instrument flying school.* 30 hours of instrument flying instruction of which at least 20 hours shall be in actual flight; and 30 hours of ground instruction in the subjects of Civil Air Regulations (the regulations in this subchapter), navigation, meteorology, and radio orientation and procedure, as applied to instrument flying.

(d) *Flight instructor school.* 25 hours of flying devoted exclusively to the science of flight instruction, and 40 hours of theoretical instruction in subjects covering the fundamentals of giving flight instruction and the analysis and performance of flight technique.

GENERAL

§ 50.20 *Application.* Application for an airman agency certificate and rating shall be made upon the form prescribed and furnished by the Administrator, and shall be accompanied by two copies of any proposed curriculum.

§ 50.21 *Display.* Display of an airman agency certificate shall be made upon the reasonable request of any person.

§ 50.22 *Duration.* An airman agency certificate shall expire 24 calendar months after the month of issuance.

§ 50.23 *Renewal.* Application for renewal of an airman agency certificate shall be made on a form furnished by the Administrator and may be mailed or presented to any inspector within 60 days prior to the month of expiration.

§ 50.24 *Transfer.* An airman agency certificate is not transferable.

§ 50.25 *Surrender.* Upon the suspension, revocation, termination, or cancellation of an airman agency certificate the holder thereof shall surrender such certificate to an authorized representative of the Administrator.

§ 50.26 *Quality of instruction.* The quality of instruction shall be such that at least 80 percent of the students who apply within 60 days after graduation will be able to qualify for pilot ratings appropriate to the curriculum from which they were graduated.

§ 50.27 *Student examinations.* Upon the completion of each subject included in an approved curriculum, each student taking the subject shall be given an appropriate examination. The student's written examination, or, in the case of a practical examination, a report thereof, shall be kept by the school for not less than 1 year from the date of the termination of the student's enrollment.

§ 50.28 *Records.* The school shall keep an accurate individual record of each student, which shall include a chronological log of all instruction, attendance, subjects covered, examinations, and examination grades. The entire record shall be certified by an authorized official of the school.

§ 50.29 *Graduation certificates.* A graduation certificate on the form prescribed by the Administrator shall be given each student graduated from a certificated airman agency school.

§ 50.30 *Inspection.* Upon reasonable request, an applicant for an airman agency certificate, or the holder of such a certificate, shall permit any authorized representative of the Administrator or the Board to inspect its personnel, facilities, equipment, and records.

§ 50.31 *Curriculum changes.* Changes in an approved curriculum shall not be made without filing immediate notification of such changes with the Administrator. Unless the school is notified to the contrary within 45 days after filing the proposed changes with the Administrator, they will be considered approved.

§ 50.32 *Maintenance of facilities, equipment, and material.* A certificated airman agency shall maintain personnel, facilities, and equipment at least equal in quality and quantity to those required for the issuance of such a certificate.

§ 50.33 *Advertising.* No certificated airman agency shall make any statement pertaining to the school which is false, or which is designed to mislead any person contemplating enrollment in the school. Any advertising which indicates that the school is approved by the Administrator shall clearly differentiate between those courses which have been approved by the Administrator and those which have not.

PART 51—GROUND INSTRUCTOR RATING

AUTHORITY: §§ 51.1 to 51.17 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 601, 607, 52 Stat. 1007, 1011; 49 U. S. C. 551, 557.

SOURCE: §§ 51.1 to 51.17 contained in Amendment 35, Civil Air Regulations, 5 F. R. 675, except as noted following sections affected.

§ 51.1 *Ground instructor rating and certificate requirements.* A ground instructor rating and certificate with respect to any ground school subject in which a certificated flying school is required to provide instruction will be issued to an applicant who complies with the following requirements:

(a) *Age.* Applicant shall be at least 18 years of age.

(b) *Character.* Applicant shall be of good moral character.

(c) *Citizenship.* Applicant shall be a citizen of the United States or of a foreign government which grants or has undertaken to grant reciprocal ground instructor privileges to citizens of the United States on equal terms and conditions with citizens of such foreign government.

(d) *Aeronautical knowledge.* Applicant shall have practical and theoretical knowledge of each ground school subject with respect to which he seeks a rating. Such knowledge shall be sufficient to accomplish satisfactorily a written examination thereon.

[Amdt. 35, 5 F. R. 675, as amended by Amdt. 51-4, 7 F. R. 989 and Amdt. 51-3, 13 F. R. 4315]

GROUND INSTRUCTOR CERTIFICATE

§ 51.2 *Application.* Application for a ground instructor certificate shall be made upon the applicable form prescribed and furnished by the Administrator.

§ 51.3 *Display.* A ground instructor certificate shall be kept readily available to the instructor at all times when he is engaged in giving instruction in any ground school subject with respect to which he is rated, and shall be presented upon the request of any student receiving such instruction, school officer, or authorized representative of the Administrator.

§ 51.4 *Duration.* A ground instructor certificate shall be of 60 days' duration, and unless the holder is otherwise notified by the Administrator within such period, it shall continue in effect thereafter until otherwise specified by the Board, unless suspended or revoked.

(a) *Temporary certificates.* The Administrator or his authorized representative may issue a temporary ground instructor certificate for a period of not to exceed 90 days, subject to the terms and conditions specified therein by the Administrator.

[Amdt. 35, 5 F. R. 675 as amended by Amdt. 51-2, 12 F. R. 4433]

§ 51.5 *Recent experience requirements.* The holder of a ground instructor certificate shall not exercise the privileges thereunder unless during the preceding twelve calendar months he has:

(1) Served for at least three months as a ground school instructor, or

(2) Demonstrated to the satisfaction of the Administrator that he is able to meet the standards currently prescribed by the regulations of this subchapter for the issuance of the certificate and rating.

§ 51.6 *Reports.* The holder of a ground instructor certificate shall transmit to the Administrator, annually, during the month of January, a report for the preceding twelve-month period, setting forth the amount and type of his aeronautical experience and such other pertinent data as the Administrator may require.

§ 51.7 *Expired certificates; special issuance.* The holder of a ground instructor certificate which has expired within the preceding twelve months may obtain a new certificate and the same rating theretofore held immediately prior to its expiration, upon application, by demonstrating to the satisfaction of the Administrator that he is able to meet the standards currently prescribed by the regulations of this subchapter for the issuance of the certificate and rating.

§ 51.8 *Nontransferability.* A ground instructor certificate is not transferable.

§ 51.9 *Surrender.* Upon the suspension, revocation, or expiration of a ground instructor certificate, the holder thereof shall, upon request, surrender such certificate to any officer or employee of the Administrator.

§ 51.10 *Reexamination.* An applicant for a ground instructor rating who has failed to pass any prescribed examination or test therefor shall not apply for reexamination for the same rating until the expiration of 30 days from the date of such failure or after he has received not less than 5 hours' instruction on each subject of the examination failed from a certificated ground instructor rated for such subject and presents a statement from such instructor showing the amount of instruction given and stating that he deems the applicant qualified to pass the required examination in such subject.

§ 51.11 *Revocation.* No person whose ground instructor certificate has been revoked shall apply for or be issued a ground instructor certificate of any rating for a period of 1 year after the revocation, except as the order of revocation may otherwise provide.

GROUND INSTRUCTOR RATING RECORD

§ 51.12 *Ground instructor rating record.* An appropriate Ground Instructor Rating Record, prescribed and issued by the Administrator, shall be attached to each ground instructor certificate issued after May 1, 1940. The ground school subject or subjects for which the holder of such certificate is rated shall be entered on such record.

§ 51.13 *Application to amend.* When any change is desired in a Ground Instructor Rating Record referred to in § 51.12, the applicant shall file a written request therefor upon the applicable form prescribed and furnished by the Administrator.

EXAMINATIONS AND TESTS

§ 51.14 *General.* The examinations and tests prescribed in this part will be conducted by an authorized representative for the Administrator.

§ 51.15 *Time and place.* All examinations and tests will be held at such times and places as the Administrator may designate.

§ 51.16 *Inspection.* An applicant for a ground instructor rating shall offer full cooperation with respect to any inspection and examination which may be made of such applicant upon proper request by any authorized representative of the Administrator prior or subsequent to the issuance of a ground instructor certificate.

§ 51.17 *Standard of performance.* All practical and theoretical examinations and tests shall be accomplished to the satisfaction of the Administrator and the passing grade in each subject shall be 70 percent.

PART 52—REPAIR STATION RATING

AUTHORITY: §§ 52.1 to 52.23 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 601, 607, 52 Stat. 1007, 1011; 49 U. S. C. 551, 557.

SOURCE: §§ 52.1 to 52.23 contained in Amendment 36, Civil Air Regulations, 5 F. R. 676, except as noted following sections affected.

§ 52.1 *Repair station ratings.*[1] Repair station ratings are as follows:

(a) Aircraft of composite construction;

(b) Aircraft of all metal construction;

(c) Aircraft engines;

(d) Aircraft metal propellers and metal propeller hubs;

(e) Aircraft wood propellers and their metal propeller hubs;

(f) Aircraft instruments.

[Amdt. 84, 5 F. R. 5146]

§ 52.2 *Repair station certificate requirements.* To be eligible for a rating as a repair station and certification as such, an applicant shall comply with the following requirements:

(a) *Personnel.* Applicant shall have adequate personnel certificated as required by this subchapter and qualified to perform or supervise the type of work involved.

(b) *Housing.* Applicant shall have suitable housing facilities which are adequately heated, lighted, and ventilated.

(c) *Inspection system.* Applicant shall have an adequate system of inspection.

(d) *Stock.* Applicant shall have a stockroom which provides for the proper storage and segregation of materials.

(e) *Drawings.* Applicant shall have adequate facilities and equipment for making drawings.

(f) *Other requirements.* Applicant shall have such equipment, facilities, and material as are necessary for the competent and efficient performance of the type of work for which a rating is sought.[1]

[Amdt. 36, 5 F. R. 676 as amended by Amdt. 84, 5 F. R. 5146]

REPAIR STATION CERTIFICATE

§ 52.10 *Application.* Application for a repair station certificate shall be made upon the applicable form prescribed and furnished by the Administrator.

§ 52.11 *Application to amend.* When any change is desired in the Repair Station Rating Record (see § 52.20) of a certificated repair station, the applicant shall apply therefor upon the applicable form prescribed and furnished by the Administrator.

§ 52.12 *Display.* A repair station certificate shall be displayed in a prominent place in the repair station.

§ 52.13 *Duration.* A repair station certificate shall be of 60 days' duration and, unless the holder thereof is otherwise notified by the Administrator within such period, shall continue in effect indefinitely thereafter, unless suspended or revoked.

[Amdt. 36, 5 F. R. 676, as amended by Amdt. 75, 5 F. R. 3946]

§ 52.14 *Nontransferability.* A repair station certificate is not transferable.

§ 52.15 *Surrender.* Upon the suspension revocation, or expiration of a repair station certificate, the holder thereof shall, upon request, surrender such certificate to any officer or employee of the Administrator.

§ 52.16 *Inspection.* An applicant for a repair station certificate shall offer full cooperation with respect to any inspection or examination which may be made of such applicant, upon proper request by any authorized representative of the Administrator, prior or subsequent to the issuance of such certificate.

§ 52.17 *Revocation.* No person whose repair station certificate has been revoked shall apply for or be issued a repair station certificate of any rating for a period of 1 year after the revocation, except as the order of revocation may otherwise provide.

[Amdt. 87, 5 F. R. 5257]

§ 52.18 *Foreign repair station certificate and ratings.* A foreign repair station certificate with appropriate ratings may be issued to a citizen of a foreign government subject to the following requirements:

(a) A repair station may be certificated only where it is necessary to provide for the maintenance, alteration, and repair of United States registered aircraft outside the United States.

(b) The applicant shall meet the requirements of this part, except that in lieu of complying with §§ 52.20, 52.42, and 52.43, the applicant shall:

(1) Have adequate personnel competent to perform or supervise the work for which the repair station is rated;

(2) Be required to maintain such records and make such reports with respect to United States registered aircraft as the Administrator finds necessary for the satisfactory administration of the privileges granted by this part.

(c) The certificate shall be limited to performance of work on aircraft which are used in operations conducted in whole or in part outside the United States and contain such operating specifications and limitations as the Administrator may prescribe to insure compliance with the applicable aircraft airworthiness requirements of the Civil Air Regulations.

(d) The certificate shall be of 6-month duration, unless sooner revoked, suspended, or terminated by a general order of the Board.

[Amdt. 52-1, 14 F. R. 623]

GENERAL RULES

§ 52.20 *Repair Station Rating Record.* An appropriate Repair Station Rating Record, prescribed and issued by the Administrator, shall be attached to each repair station certificate issued after May 1, 1940. The type of repair, alteration, maintenance, and overhaul of aircraft, aircraft engines, propellers, or appliances for which the holder of such certificate is rated shall be entered upon such record.

§ 52.21 *Maintenance of personnel, facilities, equipment, and material.* The holder of a currently effective repair station certificate shall maintain personnel, facilities, equipment, and material in conformity with the standard required for the issuance of such a certificate.

§ 52.22 *Records.* A certificated repair station shall maintain adequate records of all work performed, including records which indicate the person by whom the work was done and the person by whom it was inspected.[2] Such records shall be kept for at least 2 years.

§ 52.23 *Reporting defects or unairworthy conditions.* A report of all recurring or serious defects, or other unairworthy conditions of parts of aircraft, aircraft engines, propellers, or appliances shall be made upon the applicable forms prescribed and furnished by the Administrator: *Provided,* That if the repair station is operated by a certificated air carrier and maintains repair base records, such records may be supplied in lieu of the reports required by this section.

[Amdt. 84, 5 F. R. 5146]

PART 53—MECHANIC SCHOOL RATING

RATING CERTIFICATE REQUIREMENTS

[1] Manual No. 52, issued by the Administrator of Civil Aeronautics, sets forth in detail various types of work which he has interpreted as within the scope of repair stations rated according to § 52.1. It also carries lists of equipment, facilities, and material which the Administrator has approved as adequate under § 52.2 (f) for various types of rated repair stations. This manual may be secured by application to the Correspondence Section, Civil Aeronautics Administration, Washington 25, D. C.

[2] This is the inspection provided for in § 52.2 (c) which is to be conducted by personnel of the repair station.

STUDENT INSTRUCTION

AUTHORITY: §§ 53.1 to 53.32 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 601, 607, 52 Stat. 1007, 1011; 49 U. S. C. 551, 557.

SOURCE: §§ 53.1 to 53.32 contained in Amendment 31, Civil Air Regulations, 5 F. R. 674, as amended by Amendment 66, 5 F. R. 2739, except as noted following sections affected.

RATING CERTIFICATE REQUIREMENTS

§ 53.1 *Mechanic school rating certificate requirements.* To be eligible for a rating as a mechanic school and certification as such an applicant shall comply with the following requirements:

(a) *Curriculum.* An applicant shall have at least one of the following curricula:

(1) An aircraft curriculum which shall include instruction in the theory and practice of construction, inspection, maintenance, overhaul, and repair of aircraft and their appliances, including the applicable provisions of Parts 1–99 of this subchapter. This curriculum shall include not less than 960 hours of instruction, shall be designed to be completed in not less than 20 weeks, and shall not require attendance for more than 8 hours in any one day, or for more than 6 days in any one week.

(2) An aircraft engine curriculum which shall include instruction in the theory and practice of construction, inspection, maintenance, overhaul, and repair of aircraft power plants, propellers, and their appliances, including the applicable provisions of this subchapter. This curriculum shall include not less than 960 hours of instruction, shall be designed to be completed in not less than 20 weeks, and shall not require attendance for more than 8 hours in any one day, or for more than 6 days in any one week.

(3) A combined aircraft and engine curriculum which shall include at least 1,650 hours of instruction in the theory and practice of construction, inspection, maintenance, overhaul, and repair of aircraft, aircraft engines, propellers, and their appliances, and in the contents of the applicable regulations of this subchapter. This curriculum shall be designed to be completed in not less than 35 weeks and shall not require attendance for more than 8 hours in any one day, or for more than 6 days in any one week.

Each curriculum described in this paragraph shall provide for instruction in all the subjects necessary to qualify the student to perform the duties and functions of the position for which he may seek an airman certificate.[1]

(b) *Mechanic instructors.* The applicant shall have, for all subjects included in any approved curriculum, instructors holding valid mechanic certificates and valid ground instructor certificates, with ratings for each certificate appropriate for the subject or subjects in which such persons give instruction: *Provided,* That the applicant may be deemed to have met this requirement if he shows that any such instruction being given by a person not so rated and certificated is being given under the direct supervision of a full-time instructor with the certificate and ratings required by this paragraph.

(c) *Mechanic instructors, ratio.* The applicant shall have at least one instructor giving instruction in each subject in an approved curriculum for each 25 students simultaneously receiving instruction in that subject.

(d) *Facilities, equipment, and material.*[2] An applicant shall have the following facilities, equipment, and material:

(1) Suitable classrooms adequate to accommodate the largest number of students scheduled for attendance at any one time. Such classrooms shall be properly heated, lighted, and ventilated.

(2) Suitable shop space adequate to accommodate the largest number of students scheduled for attendance at any one time. Such shop space shall be properly heated, lighted, and ventilated.

(3) Material and equipment of the kind and quantity necessary to give each student theoretical and practical training in the use of such material and equipment sufficient to qualify him to perform the duties and functions of the position for which he may seek an airman certificate.

[Amdt. 31, 5 F. R. 673 as amended by Amdt. 53–1, 11 F. R. 6583]

STUDENT INSTRUCTION

§ 53.10 *Student examinations.* Upon completion of each subject included in any approved curriculum, each student taking such subject shall be given an appropriate examination. The student's examination, or, in the case of a practical examination, a report thereof, shall be kept by the school as a part of its records for not less than 1 year from the date of the termination of the student's enrollment.

§ 53.11 *Records.* Certificated mechanic schools shall keep an accurate individual record of each student enrolled therein, which record shall include a chronological log of all instruction, attendance, subjects covered, examinations and examination grades. The entire record shall be certified by an authorized official of the school familiar with the facts contained therein.

§ 53.12 *Reports.* On the 1st day of January and July of each year and at such other times as the Administrator may require, every holder of a mechanic school certificate shall transmit to the Administrator a correct and completely executed report on the form prescribed and furnished by the Administrator. Such report shall include the following information as to students enrolled in the course or courses approved by the Administrator:

(a) The names of all students enrolled.

(b) The course or courses for which they are enrolled.

(c) The names of the students who have been graduated within the period covered by the report and the course or courses from which graduated.

(d) The names of all students dropped from enrollment within the period covered by the report and the reasons therefor.

§ 53.13 *Graduation certificate.* Each student graduating from a certificated mechanic school who has satisfactorily completed an approved curriculum shall be given a graduation certificate executed on a form prescribed and furnished by the Administrator.

§ 53.14 *Standard of instruction.* The standard of instruction in a certificated mechanic school shall be sufficiently high to insure that an average of 8 out of 10 of its graduates, who apply within 1 year after graduation, will qualify for a mechanic certificate and rating corresponding to the curriculum from which they were graduated. This average shall be computed on the basis of the number of students, graduated by the school during each 6 months' period after May 1, 1940, who apply and are examined for the mechanic certificate and rating corresponding to the curriculum from which they were graduated.

§ 53.15 *Credit for extracurricular work.* A student who is engaged in a mechanical occupation, the nature of which is comparable to some portion of the curriculum in which he is enrolled, may receive credit for a number of hours equivalent to the experience received, in lieu of such portion of the curriculum: *Provided,* That such credit shall not exceed 400 hours in the 1,650-hour curriculum, nor 200 hours in each 960-hour curriculum.

§ 53.16 *Hours of attendance.* No student shall be given a graduation certificate unless such student has been in attendance not less than 98 percent of the total hours required by the school to complete the approved curriculum for which he was enrolled.

MECHANIC SCHOOL CERTIFICATE

§ 53.20 *Application.* Application for a mechanic school certificate shall be made upon the applicable form prescribed and furnished by the Administrator, and shall be accompanied by two copies of any proposed curriculum.

§ 53.21 *Display.* A mechanic school certificate shall be presented for inspec-

[1] The contents of the several curricula provided for are outlined in Manual 53, Mechanic School Rating.

[2] The equipment, facilities, and material which are necessary to comply with § 53.1 (d) are outlined in Manual 53, Mechanic School Rating.

tion upon the reasonable request of any person.

§ 53.22 *Duration.* A mechanic school certificate shall be of 60 days' duration and, unless the holder thereof is otherwise notified by the Administrator within such period, shall continue in effect indefinitely thereafter, unless suspended or revoked.

[Amdt. 31, 5 F. R. 673 as amended by Amdt. 75, 5 F. R. 3946]

§ 53.23 *Nontransferability.* A mechanic school certificate is not transferable.

§ 53.24 *Surrender.* Upon the suspension, revocation, or expiration of a mechanic school certificate, the holder of such certificate shall, upon request, surrender such certificate to any officer or employee of the Administrator.

§ 53.25 *Inspection.* The applicant for a mechanic school certificate shall offer full cooperation with respect to any inspection or examination which may be made of said applicant, its personnel, facilities, equipment, and records, upon proper request by an authorized representative of the Administrator prior or subsequent to the issuance of a mechanic school certificate.

§ 53.26 *Revocation.* No person whose mechanic school certificate has been revoked shall apply for or be issued a mechanic school certificate for a period of 1 year after the revocation, except as the order of revocation may otherwise provide.

[Amdt. 87, 5 F. R. 5256]

GENERAL RULES

§ 53.30 *Advertising.* No certificated mechanic school shall in any manner make any statement pertaining to such school which is false or is designed to mislead any person contemplating enrollment in such school: *Provided,* That any advertising which indicates that such school is approved by the Administrator shall clearly differentiate between those subjects which have been approved by the Administrator and those which have not.

§ 53.31 *Curriculum changes.* No change shall be made in any approved curriculum prior to approval of the change by the Administrator. Unless the school is notified to the contrary within 60 days after submission of the proposed change to the Administrator, such change will be deemed to have been approved.

§ 53.32 *Maintenance of facilities, equipment, and material.* The holder of a currently effective mechanic school certificate shall maintain personnel, facilities, equipment, and material at least equal in quality and quantity to those required for the issuance of such a certificate.

PART 54—PARACHUTE LOFT CERTIFICATES AND RATINGS

RATINGS

Sec.
54.1 Parachute loft ratings.

REQUIREMENTS

54.2 Certificate requirements.

ISSUANCE AND DURATION

54.3 Application.
54.4 Duration.
54.5 Application to amend.

REGULATIONS AND LIMITATIONS

54.10 Display.
54.11 Transfer.
54.12 Surrender.
54.13 Inspection.
54.14 Revocation.
54.15 Records.
54.16 Parachute Loft Rating Record.
54.17 Recording major repair and alteration operations.
54.18 Maintenance, personnel, facilities, equipment, and material.
54.19 Quality of maintenance, repairs, and alterations.
54.20 Materials.
54.21 Reporting defects or unairworthy conditions.
54.22 Agencies authorized to perform maintenance, repairs, alterations, and inspections.
54.23 Drop testing of parachutes.

DEFINITIONS

54.30 Parachute.
54.31 Manufacturer.
54.32 Routine maintenance.
54.33 Minor repairs.
54.34 Major repairs.
54.35 Alterations.
54.36 Minor alterations.
54.37 Major alterations.
54.38 Overhaul.

AUTHORITY: §§ 54.1 to 54.38 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 601, 607, 52 Stat. 1007, 1011; 49 U. S. C. 551, 557.

SOURCE: §§ 54.1 to 54.38, contained in Amendment 54-0, Civil Air Regulations, 8 F. R. 1334.

RATINGS

§ 54.1 *Parachute loft ratings.* The following ratings may be issued prescribing the type of work the holder of a parachute loft certificate is qualified to perform:

(a) General maintenance and minor repair;
(b) Canopy overhaul;
(c) Harness overhaul;
(d) Metal parts and container overhaul;
(e) Drop testing.

REQUIREMENTS

§ 54.2 *Certificate requirements.* To be eligible for a rating as a parachute loft and certification as such an applicant shall comply with the following requirements:

(a) *Personnel.* Applicant shall have adequate personnel certificated in accordance with the provisions of Part 25 of this subchapter and qualified to perform or supervise the type of work involved.

(b) *Facilities and equipment.* Applicant shall have such equipment, facilities, and material as are necessary for the competent and efficient performance of the type of work for which a rating is sought. Such facilities shall include suitable and adequately heated, lighted, and ventilated housing; an adequate system of inspection; adequate equipment for making drawings; and adequate facilities for the segregation and storage of parts and materials.

NOTE: A manual will be issued outlining facilities, equipment, and personnel which will comply with the requirements of this section.

ISSUANCE AND DURATION

§ 54.3 *Application.* Application for a parachute loft certificate and appropriate ratings shall be made upon the applicable form prescribed and furnished by the Administrator.

§ 54.4 *Duration.* A parachute loft certificate shall remain in effect indefinitely, unless suspended or revoked: *Provided,* That such certificate may be canceled by the Administrator at any time within 60 days after issuance.

§ 54.5 *Application to amend.* Application for a change in the Parachute Loft Rating Record of a certificated parachute loft shall be made upon the applicable form prescribed and furnished by the Administrator.

REGULATIONS AND LIMITATIONS

§ 54.10 *Display.* A parachute loft certificate shall be displayed in a prominent place in the parachute loft.

§ 54.11 *Transfer.* A parachute loft certificate may not be transferred.

§ 54.12 *Surrender.* Upon the suspension, revocation, or expiration of a parachute loft certificate, the holder thereof upon request shall surrender such certificate to any officer or employee of the Administrator.

§ 54.13 *Inspection.* An applicant for a parachute loft certificate shall cooperate fully in any inspection or examination which may be made of such applicant, applicant's personnel, facilities, equipment, and records, upon proper request by an authorized representative of the Administrator, prior or subsequent to the issuance of a parachute loft certificate.

§ 54.14 *Revocation.* No person whose parachute loft certificate has been revoked shall apply for or be issued a parachute loft certificate or any rating for a period of one year after the revocation of such certificate except as the order of revocation may otherwise provide.

§ 54.15 *Records.* The holder of a parachute loft certificate shall maintain adequate records, which shall include the names of the persons who performed the work and the type of work performed. Such records shall be kept for at least two years.

§ 54.16 *Parachute Loft Rating Record.* An appropriate Parachute Loft Rating Record prescribed and issued by the Administrator shall be attached to each parachute loft certificate issued. The record shall contain the type of repair, operation, maintenance, and overhaul of parachutes for which the holder of such certificate is rated.

§ 54.17 *Recording major repair and alteration operations.* The holder of a parachute loft certificate authorized to perform major repair and alteration operations on a parachute canopy, harness, container, accessory, or any combination thereof, shall execute such repair and alteration forms as may be prescribed and furnished by the Administrator and shall deliver a copy of such form to the owner of the parachute.

§ 54.18 *Maintenance, personnel, facilities, equipment, and material.* The holder of a currently effective parachute loft certificate shall maintain personnel, facilities, equipment, and material at least equal in quantity and quality to those currently required for original issuance of such a certificate and the appropriate ratings.

§ 54.19 *Quality of maintenance, repairs, and alterations.* The holder of a parachute loft certificate shall perform maintenance, repair, and alteration operations in a workmanlike manner and so as to maintain the equipment in, or restore it to an airworthy condition.

§ 54.20 *Materials.* The holder of a parachute loft certificate shall use materials in connection with maintenance, repair, and alteration operations of such quality and strength as to be suitable for the purposes used.

§ 54.21 *Reporting defects or unairworthy conditions.* The holder of a parachute loft certificate shall report upon the applicable forms prescribed and furnished by the Administrator all recurring or serious defects or other unairworthy conditions of parachutes or parts thereof.

§ 54.22 *Agencies authorized to perform maintenance, repairs, alterations, and inspections.* Maintenance, repairs, alterations, and inspections of certificated parachutes may be performed by:

(a) A certificated parachute technician of appropriate grade and ratings (see Part 25 of this subchapter for service limitations of certificated parachute technicians); or

(b) A certificated parachute loft having an appropriate rating; or

(c) The manufacturer of the parachute or part thereof; or

(d) Another parachute manufacturer deemed competent by the Administrator: *Provided*, That all maintenance, repairs, alterations, and inspections shall be performed in accordance with manuals and specifications approved by the Administrator.[1]

§ 54.23 *Drop testing of parachutes.* The holder of a parachute loft certificate shall drop test any major repaired or altered parachute canopy, harness, container, accessory, or any combination thereof, when in the opinion of the inspecting certificated parachute technician such repairs or alterations may have affected its structural, functional, or other airworthiness characteristic. Drop tests shall be conducted in accordance with the following conditions:

(a) *Functional tests.* If it is necessary to determine the functional characteristics of the entire assembly, such assembly shall be drop tested with a 150-pound dummy man (not including the weight of the parachute) at an indicated air speed of 70 miles per hour and a minimum altitude of 500 feet above the ground.

(b) *Strength tests.* If it is necessary to determine the material values in the entire assembly, such assembly shall be drop tested with a 190-pound dummy man (not including the weight of the parachute) at an indicated air speed of 120 miles per hour and a minimum altitude of 500 feet above the ground.

(c) *Airworthiness tests.* If it is necessary to determine material airworthiness of the entire assembly prior to repairs of any kind, such assembly shall be drop tested with a 190-pound dummy man (not including the weight of the parachute) at an indicated air speed of 120 miles per hour and at a minimum altitude of 500 feet above the ground.

(d) *Agencies authorized to perform drop testing operations.* Parachute drop testing operations shall be performed only by:

(1) The manufacturer of the parachute; or

(2) Another parachute manufacturer deemed competent by the Administrator; or

(3) A certificated parachute loft having an appropriate rating.

DEFINITIONS

§ 54.30 *Parachute.* A unit comprised of a canopy, harness, container, and accessories, so arranged in combination as to allow instantaneous release of a folded canopy by means of mechanical control or manually operated release device, such combination to be approved by the Administrator.

(a) *Canopy.* That part of a parachute combination which is designed to retard the descent of a falling body or object.

(b) *Harness.* That part of a parachute combination designed to enfold or carry the body or object and to serve as an attachment between the canopy and its intended cargo.

(c) *Container.* That part of a parachute combination designed to hold or contain a folded canopy.

(d) *Accessory.* That part or parts of a parachute combination necessary to complete a unit as designed by the manufacturer and approved by the Administrator.

§ 54.31 *Manufacturer.* (a) The holder of a type certificate for the manufacture of a canopy, harness, container, or accessory, or any combination thereof, or of the current rights under licensing arrangements to the benefits of such type certificate; or

(b) The maker of a part or accessory of a certificated parachute: *Provided*, That such maker shall have in his employ a properly certificated parachute technician in direct charge of maintenance, repair, or alteration operations.

§ 54.32 *Routine maintenance.* An operation limited to the packing of parachutes and the replacement of small standard parts not involving complex assembly operations.

§ 54.33 *Minor repairs.* Elementary repair operations executed in accordance with standard practices and not within the definition of major repairs.

§ 54.34 *Major repairs.* Complex repair operations of vital importance to the airworthiness of a parachute.

§ 54.35 *Alterations.* Any appreciable change in the design or an exchange of parts in a parachute canopy, harness, container, accessory, or any combination thereof.

§ 54.36 *Minor alterations.* (a) An alteration having no appreciable effect on the structural, functional, or other characteristic, affecting the airworthiness of a parachute canopy, harness, container, accessory, or combination thereof, individually or as a unit;

(b) An alteration for which specific plans and instructions have been approved by the Administrator and which can be executed by minor elementary operations.

§ 54.37 *Major alterations.* All alterations not within the definition of minor alterations.

§ 54.38 *Overhaul.* Maintenance, inspection, repairs, and alterations performed in accordance with manuals and specifications, and approved by the Administrator.

PART 60—AIR TRAFFIC RULES

GENERAL

[1] Manuals and specifications may be issued by a parachute manufacturer or by the Administrator. In either case they must be approved by the Administrator.

AUTHORITY: §§ 60.1 to 60.89 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply sec. 601, 52 Stat. 1007; 49 U. S. C. 551.

SOURCE: §§ 60.1 to 60.89 contained in Amendment 60-0, Civil Air Regulations, 12 F. R. 5547, except as noted following sections affected.

NOTE: The statements contained in the notes are intended as explanation only and shall not be construed as official interpretations of the regulations.

GENERAL

§ 60.1 *Scope.* The air traffic rules in this part shall apply to aircraft operated anywhere in the United States, including the several States, the District of Columbia, and the several Territories and possessions of the United States, including the territorial waters and the overlying airspace thereof, except:

(a) Military aircraft of the United States armed forces when appropriate military authority determines that non-compliance with this part is required and prior notice thereof is given to the Administrator, and

(b) Aircraft engaged in special flight operations, requiring deviation from this part, which are conducted in accordance with the terms and conditions of a certificate of waiver issued by the Administrator.

NOTE: Specific operations which cannot be conducted within the provisions of the regulations in this part, such as air races, air meets, acrobatic flights, or certain pest control or seeding operations require, prior to commencement of the operation, a certificate of waiver which may be obtained from the nearest office of CAA.

§ 60.1a *Operation over the high seas.* Aircraft of United States registry operated in air commerce shall while over the high seas comply with the provisions of Annex 2 (Rules of the Air) to the Convention on International Civil Aviation.

NOTE: An airman who complies fully with Part 60 while over the high seas will also be in compliance with Annex 2. Under Article 12 of the Convention on International Civil Aviation, the member states undertake to make their regulations conform to the greatest possible extent to the ICAO Annexes. It may therefore be expected that the provisions of Annex 2 will be generally applicable to flight over the territory of member states of the International Civil Aviation Organization.

[Amdt. 60-4, 14 F. R. 1486]

§ 60.2 *Authority of the pilot.* The pilot in command of the aircraft shall be directly responsible for its operation and shall have final authority as to operation of the aircraft. In emergency situations which require immediate decision and action the pilot may deviate from the rules prescribed in this part to the extent required by consideration of safety. When such emergency authority is exercised, the pilot, upon request of the Administrator, shall file a written report of such deviation. In an emergency situation which results in no deviation from the rules prescribed in this part but which requires air traffic control to give priority to an aircraft, the pilot of such aircraft shall make a report within 48 hours of such emergency situation to the nearest regional office of the Administrator.

GENERAL FLIGHT RULES (GFR)

§ 60.10 *Application.* Aircraft shall be operated at all times in compliance with the following general flight rules and also in compliance with either the visual flight rules or the instrument flight rules, whichever are applicable.

§ 60.11 *Preflight action.* Before beginning a flight, the pilot in command of the aircraft shall familiarize himself with all available information appropriate to the intended operation. Preflight action for flights away from the vicinity of an airport, and for all IFR flights, shall include a careful study of available current weather reports and forecasts, taking into consideration fuel requirements, an alternate course of action if the flight cannot be completed as planned, and also any known traffic delays of which he has been advised by air traffic control.

§ 60.12 *Careless or reckless operation.* No person shall operate an aircraft in a careless or reckless manner so as to endanger the life or property of others.

NOTE: Examples of aircraft operation which may endanger the lives or property of others are:

(a) Any person who "buzzes", dives on, or flies in close proximity to a farm, home, any structure, vehicle, vessel, or group of persons on the ground. In rural districts the flight of aircraft at low altitude often causes injury to livestock. A pilot who engages in careless or reckless flying and who does not own the aircraft which he is flying unduly endangers the aircraft, the property of another.

(b) The operation of aircraft at an insufficient altitude endangers persons or property on the surface or passengers within the aircraft. Such a flight may also constitute a violation of § 60.17.

(c) Lack of vigilance by the pilot to observe and avoid other air traffic. In this respect, the pilot must clear his position prior to starting any maneuver, either on the ground or in flight.

(d) Passing other aircraft too closely.

(e) An operation conducted above a cloud layer in accordance with VFR minimums which results in the pilot becoming involved in instrument flight, unless the pilot possesses a valid instrument rating, the aircraft is properly equipped for instrument flight, and all IFR requirements are observed.

§ 60.13 *Airspace restricted areas.* The Administrator may designate as a danger area an area within which he has determined that an invisible hazard to aircraft in flight exists. No person shall operate an aircraft within an airspace reservation or danger area unless permission for such operation has been issued by appropriate authority.

NOTE: Airspace restricted areas are established in order to conduct certain essential activities which might endanger air traffic passing over or near the location thereof. Airspace restricted areas are shown on aeronautical charts and in publications of aids to air navigation. Avoidance of such areas is imperative to the safety of flight unless prior permission for flight through the area has been secured from the agency having jurisdiction over the airspace reservation or danger area.

§ 60.13-1 *Danger areas (CAA rules which apply to § 60.13).* The following areas are hereby designated as danger areas:

ALABAMA

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Camp Rucker (Mobile Chart).	Beginning at lat. 31°31′00″ N, long. 85°53′10″ W; E to long. 85°42′30″ W; SSE to lat. 31°21′45″ N, long. 85°40′00″ W; E to long. 85°37′30″ W; SSE to lat. 31°20′00″ N, long. 85°37′00″ W; SW to lat. 31°19′15″ N, long. 85°38′45″ W; NW to lat. 31°21′00″ N, long. 85°42′10″ W; W to long. 85°53′40″ W; N to lat. 31°31′00″ N, long. 85°53′40″ W, point of beginning.	Surface to 30,000 feet	Continuous	Hdq., 3d Army, Fort McPherson, Ga.
Fort McClellan (Birmingham Chart).	Beginning at lat. 33°45′00″ N, long. 85°46′50″ W; E to long. 85°43′30″ W; S to lat. 33°39′00″ N; W to long. 85°49′00″ W; NW to lat. 33°40′30″ N, long. 85°49′30″ W; N to lat. 33°41′15″ N; E to long. 85°47′15″ W; NE to lat. 33°45′00″ N, long. 85°46′50″ W, point of beginning.	do	do	Do.
Huntsville (Chattanooga Chart).	Straight lines connecting the following points: lat. 34°36′00″ N long. 86°41′30″ W; lat. 34°42′00″ N, long. 86°41′30″ W; lat. 34°42′00″ N, long. 86°44′30″ W.	Surface to 5,000 feet	Daylight hours only	Huntsville Arsenal, Huntsville, Ala.

ARIZONA

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
AJO (Phoenix and San Diego Charts).	Beginning at lat. 32°49'30" N, long. 112°19'00" W; S to lat. 32°35'40" N; W to long. 112°36'30" W; S to lat. 32°31'00" N; W to long. 112°57'00" W; S to lat. 32°20'00" N; W to long. 113°02'00" W; S to lat. 32°13'00" N; W to long. 113°27'00" W; S to Mexican Border; NW along Mexican Border to long. 114°00'00" W; N to lat. 32°35'00" N; E to long. 113°27'00" W; N to lat. 32° 48'40" N; to lat. 32°49'30" N; long. 113°21'00" W; to lat. 32°49'30" N, long. 112° 19'00" W, point of beginning.	Surface to 40,000 feet	Continuous	Air Force Training Command, Ajo, Ariz.
Sahuarita (Douglas and Phoenix Charts).	N boundary: lat. 32°02'00" N; E boundary: long. 110°51'00" W; S boundary: lat. 31° 54'00" N; W boundary: long. 110°57'00" W.	Surface to 30,000 feet	do	Davis-Monthan AFB, Tucson, Ariz.
Willcox Dry Lake (Phoenix Chart).	N boundary: lat. 32°14'00" N; E boundary: long. 109°39'00" W; S boundary: lat. 32°06'30" N; W boundary: long. 110°00'30" W.	do	do	Do.

ARKANSAS

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Little Rock (Little Rock chart).	N boundary, latitude 34°57'00" N. E boundary: longitude 92°15'00" W. S boundary: latitude 34°52'00" N. W boundary: longitude 92°22'00" W.	Surface to 9,000 feet	Daylight hours only, June 12 through June 26, 1949; Saturday and Sunday only thereafter	Arkansas Air National Guard, Little Rock Ark

CALIFORNIA

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Antioch (Sacramento Chart).	A circular area having a radius of 2 miles centered at lat. 38°02'00" N, long. 121°36'00" W.	Surface to 10,000 feet	0900 to 1700 daily	12th Naval District, San Francisco, Calif.
Camp Beale (San Francisco Chart).	Beginning at lat. 39°15'00" N, long. 121°09'00" W; to lat. 39°00'00" N, long. 121°09'00" W; to lat. 39°00'00" N, long. 121°15'00" W; to lat. 39°03'00" N, long. 121°28'30" W; to lat. 39°15'00" N, long. 121°30'00" W; to lat. 39°15'00" N, long. 121°09'00" W, point of beginning.	Surface to 15,000 feet	Continuous	USAF Bombardment School, Mather AFB.
Camp Pendleton (San Diego Chart).	Beginning at lat. 33°24'23" N, long. 117° 15'15" W; to lat. 33°18'00" N, long. 117°16'08" W; to lat. 33°17'00" N, long. 117°17'30" W; to lat. 33°17'30" N, long. 117° 21'30" W; to lat. 33°27'14" N, long. 117°34'00" W; to lat. 33°30'13" N, long. 117°29'13" W; to lat. 33°24'23" N, long. 117°15'15" W, point of beginning.	do	Continuous Monday through Saturday.	USMC, Camp Pendleton. Calif.
Carrizo Valley (San Diego Chart).	N boundary: lat. 32°58'58" N; E boundary: long. 115°59'00" W; S boundary: lat. 32°50'24" N; W boundary: long. 116°04'36" W.	Surface to 10,000 feet	Daylight hours only	11th Naval District, San Diego, Calif.
China Lake (Mt. Whitney and Los Angeles Charts).	Beginning at lat. 36°14'00" N, long. 117°24'00" W; S to lat. 36°00'00" N; to lat. 35°39'00" N, long. 117°37'00" W; to lat. 35°38'00" N, long. 117°38'00" W; W to long. 117°47'00" W; to lat. 36°00'00" N, long. 117°54'00" W; to lat. 36°14'00" N, long. 117°55'00" W; to lat. 36°14'00" N, long. 117°24'00" W, point of beginning.	Unlimited	Daylight hours only Monday through Friday.	Do.
Chocolate Mountains (San Diego Chart).	Beginning at lat. 33°32'40" N, long. 115°33'50" W; SE along a road to lat. 33°25'50" N, long. 115°14'30" W; to lat. 33°24'15" N, long. 115°17'00" W; SE and NE along a road to lat. 33°22'50" N, long. 115°09'58" W; to lat. 33°07'30" N, long. 114°55'35" W; SW along a road to lat. 33°00'00" N, long. 115°04'00" W; NW along railroad to lat. 33°09'40" N, long. 115°19'30" W; to lat. 33°12'55" N, long. 115°24'00" W; to lat. 33°28'30" N, long. 115°42'10" W; to lat. 33°32'40" N, long. 115°33'50" W, point of beginning.	Surface to 30,000 feet	0900 to 1800 daily	Do
El Centro (San Diego Chart)	Beginning at lat. 32°55'45" N long. 115°51'30" W; to lat. 32°50'05" N, long. 115°47'00" W; to lat. 32°50'05" N, long. 115°55'00" W; to lat. 32°55'45" N, long. 115°55'00" W; to lat. 32°55'45" N, long. 115°51'30" W, point of beginning.	Surface to 10,000 feet	Continuous	Do.
El Toro (San Diego Chart).	A circular area having a radius of 3 miles centered at lat. 33°37'45" N, long. 117°36'00" W.	Surface to 15,000 feet	0830 to 1630 daily	Do.
Fort Ord (San Francisco Chart).	Beginning at lat. 36°40'59" N, long. 121°48'49" W; to lat. 36°41'49" N, long. 121°45'19" W; to lat. 36°37'35" N, long. 121°41'17" W; to lat. 36°34'54" N, long. 121°43'01" W; to lat. 36°34'30" N, long. 121°47'40" W; along the arc of a circle of 3 mile radius centered at lat. 36°35'30" N long. 121°50'30" W; to lat. 36°38'00" N, long. 121°50'20" W; to lat. 36°40'59" N, long. 121°48'49" W, point of beginning.	do	Continuous	Hdq., 6th Army, Presidio. San Francisco, Calif.
Holtville (San Diego Chart).	(1) A circular area with a 1,000 yard radius centered at lat. 32°56'45" N, long. 115°12'00" W.	do	0830 to 1530 daily	11th Naval District, San Diego, Calif.
	(2) A circular area with a 1,000 yard radius centered at lat. 32°55'10" N, long. 115°16'15" W.	do	do	Do.
	(3) A circular area with a 1,000 yard radius centered at lat. 33°01'36" N, long. 115°18'48" W.	do	do	Do.
Muroc Lake (Los Angeles Chart).	Beginning at lat. 35°00'00" N, long. 117°32'00" W; S to lat. 34°48'30" N; to lat. 34°48'00" N, long. 117°35'00" W; W to long. 117°55'00" W; N to lat. 35°00'00" N; to lat. 35°00'00" N, long. 117°32'00" W, point of beginning.	Surface to 45,000 feet	Daylight hours only	Muroc Lake AFB, Muroc Lake, Calif.
Offshore of California (San Diego Chart).	A circular area with a 300 yard radius centered at lat. 33°02'04" N, long. 118°36'47" W.	Surface to 15,000 feet	Continuous	12th Naval District, San Francisco, Calif.
Petaluma (Sacramento Chart).	A circular area with a radius of 2½ miles centered at lat. 38°11'00" N, long. 122°33'00" W.	Surface to 10,000 feet	0900 to 1700 daily	11th Naval District, San Diego, Calif.
Point Reyes (Sacramento Chart).	A circular area having a radius of 7 miles centered at lat. 38°09'30" N, long. 122°56'30" W.	do	do	Do.
Salton Sea (San Diego Chart).	(1) A circular area having a 3 miles radius centered at lat. 33°11'00" N, long. 116°09'30" W.	Surface to 15,000 feet	Continuous	Do.
	(2) Beginning at lat. 33°18'00" N, long. 115°44'00" W; to lat. 33°18'00" N, long. 115°53'20" W; to lat. 33°11'30" N, long. 115°50'30" W; to lat. 33°11'00" N, long. 115°49'40" W, to lat. 33°11'00" N, long. 115°44'00" W; to lat. 33°18'00" N, long. 115°44'00" W, point of beginning.	Unlimited	do	National Defense Agencies.
San Diego (San Diego Chart).	(1) A circular area having a radius of 3 miles centered at lat. 32°35'35" N, long. 116°56'21" W.	Surface to 15,000 feet	do	11th Naval District, San Diego, Calif.
	(2) A circular area having a radius of 3 miles centered at lat. 33°00'49" N, long. 117°08'48" W, excluding that portion that lies within Blue Civil Airway No. 14.	do	do	Do.
	(3) A circular area having a radius of [illegible] miles centered at lat. 32°55'05" N, long. 117°00'15" W.	do	do	Do.
San Miguel Island, Off-Shore, Calif. (San Francisco Chart).	W boundary: long. 120°30'00" W; E boundary: long. 120°17'30" W; N boundary. lat. 34°07'00" N; S boundary: lat. 33°58'30" N.	Surface to 30,000 feet	Daylight hours only	Do
Trona (Mount Whitney and Los Angeles Charts).	Beginning at lat. 36°00'40" N, long. 116°51'50" W; to lat. 35°35'00" N, long. 116°55'50" W; W to long. 117°00'00" W; S to lat. 35°09'00" N; W to long. 117°19'00" W; to lat. 36°00'40" N, long. 117°13'00" W; to lat. 36°00'40" N, long. 116°51'50" W, point of beginning.	Unlimited	Daylight hours only Monday through Friday.	Do.

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
COLORADO				
Camp Carson (Denver Chart).	Straight lines connecting the following points: lat. 38°39'00" N, long. 104°48'00" W; lat. 38°32'00" N, long. 104°46'30" W; lat. 38°32'00" N, long. 104°52'00" W; lat. 38°39'00" N, long. 104°58'00" W.	Surface to 14,500 feet	Daylight hours only	U. S. Army, Mountain Training Center, Camp Carson, Colo.
Parker (Denver Chart)	N boundary: lat. 39°41'00" N; E boundary: long. 104°26'00" W; S boundary: lat. 39°34'00" N; W boundary: long. 104°43'00" W.	do	do	NAS Buckley Field, Denver, Colo.
DELAWARE				
Little Creek (Washington Chart).	Beginning at lat. 39°21'00"N, long. 75°25'30" W; SE to lat. 39°15'00" N, long. 75°21'00" W; SW to lat. 39°10'00" N, long. 75°25'00" W; SW to lat. 39°09'30" N, long. 75°26'00" W; NW to lat. 39°17'00" N, long. 75°32'00" W; NE to lat. 39°21'00" N, long. 75°25'30" W, point of beginning.	Surface to 2,000 feet	Continuous from July 1 to Sept. 1, 1949.	Dover AFB, Dover, Del.
FLORIDA				
Banana River (Orlando Chart).	Beginning at lat. 28°50'00" N, long. 80°50'00" W; E to a point 3 nautical miles from the shoreline at long. 80°41'35" W; southeasterly along a line paralleling the shoreline at a distance of 3 nautical miles to lat. 28°14'40" N, long. 80°32'30" W; NW to the shoreline at lat. 28°17'00" N, long. 80°36'00" W; NW to lat. 28°50'00" N, long. 80°50'00" W, point of beginning.	Unlimited	Continuous	8th Naval District, Charleston, S. C.
Bostwick (Orlando Chart)	A circular area with a radius of 3 miles centered at lat. 29°47'00" N, long. 81°41'00" W.	Surface to 20,000 feet	do	NAS, Jacksonville, Fla.
Chassahowitzka Bay (Orlando Chart).	Beginning at lat. 28°48'00" N, long. 82°45'00" W; due S to a point 3 nautical miles from the shoreline at lat. 28°40'15" N; northwesterly paralleling the shoreline at a distance of 3 nautical miles to lat. 28°48'00" N, long. 82°49'05" W; due E to lat. 28°48'00" N, long. 82°45'00" W, point of beginning.	Surface to 50,000 feet	Daylight hours only	15th Air Force Units, MacDill AFB, Tampa, Fla.
Jacksonville (Jacksonville Chart).	Beginning at lat. 30°19'20" N, long. 81°38'10" W; to lat. 30°10'45" N, long. 81°35'00" W; S to lat. 29°55'00" N; W to long. 81°55'00" W; N to lat. 29°59'00" N; W to long. 82°02'00" W; N to lat. 30°03'00" N; W to long. 82°20'00" W; N to lat. 30°22'00" N; to lat. 30°21'10" N, long. 81°50'00" W; to lat. 30°18'40" N, long. 81°52'40" W; to lat. 30°16'45" N, long. 81°50'15" W; E to long. 81°41'30" W; to lat. 30°19'20" N, long. 81°38'10" W, point of beginning.	Surface to 12,000 feet	do	Jacksonville Naval Air Station, Jacksonville, Fla.
Miami (Miami Chart)	Beginning at west edge of Amber Civil Airway No. 7 at lat. 26°15'00" N, long. 80°16'30" W; SSW along the west edge of Amber Civil Airway No. 7 to lat. 26°00'00" N, long. 80°18'05" W; west to the edge of Blue Civil Airway No. 19 at long. 80°23'30" W; north-northwest along the east edge of Blue Civil Airway No. 19 to lat. 26°15'00" N, long. 80°25'45" W; thence east to lat. 26°15'00" N, long. 80°16'30" W, point of beginning.	Surface to 20,000 feet	do	Naval Air Station, Miami, Fla.
Pensacola (Mobile Chart)	(1) Area 1: Beginning on the shoreline at lat. 30°23'30" N, long. 86°45'00" W; due S to a point 3 nautical miles from the shoreline at lat. 30°20'30" N; westerly along a line paralleling the shoreline at a distance of 3 nautical miles to the eastern edge of Pensacola Control Area at lat. 30°18'00" N, long. 87°02'50" W; northerly along the boundary of Pensacola Control Area to its intersection at lat. 30°22'05" N, long. 87°04'30" W with a circular arc of 2 mile radius centered at lat. 30°21'42" N, long. 87°92'36" W; thence clockwise around that arc to its intersection with and clockwise around a circular arc of 2 miles radius centered at lat. 30°22'06" N, long. 86°58'48" W, to the shoreline at lat. 30°22'00" N, long. 86°56'40" W; easterly along the shoreline to lat. 30°23'30" N, long. 86°45'00" W, point of beginning.	Surface to 12,000 feet	do	NAS, Pensacola, Fla.
	(2) Area 2: Beginning at the intersection of the shoreline with the western edge of Persacola Control Area at lat. 30°19'00" N, long. 87°13'30" W; southerly along the boundary of Pensacola Control Area to a point 3 nautical miles from the shoreline at lat. 30°16'15" N, long. 87°12'45" W; westerly along a line paralleling the shoreline at a distance of 3 nautical miles to the eastern edge of the Mobile, Alabama control area extension, at lat. 30°12'00" N, long. 87°39'00" W; northwesterly along the control area extension boundary to the shoreline at lat. 30°15'00" N, long. 87°41'30" W; easterly along the shoreline to lat. 30°16'15" N, long. 87°33'40"; thence clockwise around a circular arc of 2 mile radius centered at lat. 30°16'48" N, long. 87°32'10" W, to the shoreline at lat. 30°17'00" N, long. 87°30'00" W; easterly along the shoreline to lat. 30°17'20" N, long. 87°29'00" W; thence clockwise around a circular arc of 2 mile radius centered at lat. 30°17'47" N, long. 87°27'28" W; to the shoreline at lat. 30°17'50" N, long. 87°25'30" W; easterly along the shoreline to lat. 30°18'15" N, long. 87°23'30" W; thence clockwise around a circular arc of 2 mile radius centered at lat. 30°18'54" N, long. 87°21'26" W; to the shoreline at lat. 30°19'00" N, long. 87°19'30" W; E to lat. 30°19'20" N, long. 87°18'00" W; easterly along the shoreline to the western edge of Pensacola Contro lArea at lat. 30°19'00" N, long. 87°13'30" W, point of beginning.	do	do	Do.
	(3) Area 3: Beginning at the intersection of the shoreline and the western edge of the Mobile, Alabama control area extension at lat. 30°13'00" N, long. 87°49'30" W; southeasterly along the control area extension boundary to a point 3 nautical miles from the shoreline at lat. 30°11'00" N, long. 87°47'00" W; westerly along a line paralleling the shoreline at a distance of 3 nautical miles to lat. 30°10'05" N, long. 88°01'30" W; due N to the shoreline at lat. 30°13'00" N, easterly along the shoreline to the western edge of the Mobile control area extension at lat. 30°13'00" N, long. 87°49'30" W, point of beginning. N. B. For other Pensacola, Florida, areas see under "Florida" *supra*	do	do	Pensacola Naval Air Station, Pensacola, Fla.
Pinecastle (Orlando Chart).	(1) A circular area having a radius of 4 miles centered at lat. 29°06'45" N, long. 81°43'00" W. (2) A circular area having a radius of 4 miles centered at lat. 29°09'30" N, long. 81°42'00" W	Surface to 30,000 feet	do	14th Air Force, Orlando AFB, Orlando, Fla.
Rainbow Point (Orlando Chart).	Beginning at lat. 28°33'00" N, long. 82°43'00" W; due S to lat. 28°23'00" N; due W to a point 3 nautical miles from the shoreline at long. 82°45'35" W; northerly paralleling the shoreline at a distance of 3 nautical miles to lat. 28°33'00" N, long. 82°43'20" W; due E to lat. 28°33'00" N, long. 82°43'00" W, point of beginning.	Surface to 50,000 feet	do	15th Air Force Units, MacDill AFB, Tampa, Fla.

FLORIDA—Continued

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Sebring (Miami Chart)	Beginning at lat. 27°38′45″ N, long. 81°07′30″ W; SW along the Kissimmee River to lat. 27°32′30″ N, long. 81°11′20″ W; due W to long. 81°21′00″ W; northerly along Arbuckle Creek to lat. 27°38′00″ N, long. 81°21′30″ W; counterclockwise along the arc of a circle with a one mile radius centered at lat. 27°38′45″ N, long. 81°20′00″ W to lat. 27°39′20″ N, long. 81°21′45″ W; NW along creek and eastern shore of Lake Arbuckle to lat. 27°45′30″ N, long. 81°26′00″ W; E and NE along the road to lat. 27°46′30″ N, long. 81°20′30″ W; due E to long. 81°17′20″ W; due S to lat. 27°46′15″ N SE to lat. 27°41′45″ N, long. 81°12′15″ W; due S to lat. 27°40′50″ N; due E to long. 81°11′30″ W; due S to lat. 27°38′45″ N; due E to lat. 27°38′45″ N, long. 81°07′30″ W, point of beginning.	Surface to 50,000 feet	Daylight hours only	MacDill AFB, Tampa, Fla.
Valparaiso (Mobile Chart)	Beginning at a point on the southern edge of Red Civil Airway No. 30 at lat. 30°43′50″ N, long. 86°10′30″ W; thence counterclockwise around a circular arc of 3 mile radius centered at lat. 30°45′00″ N, long. 86°07′40″ W; to lat. 30°42′30″ N, long. 86°07′10″ W; southerly along the De Funiak Springs-Freeport Highway (State Highway No. 83) to the town of Freeport at lat. 30°30′00″ N, long. 86°08′00″ W; due S to the shoreline at lat. 30°19′00″ N, long. 86°08′00″ W; southeasterly along the shoreline to lat. 30°18′00″ N, long. 86°05′10″ W; SE to a point 3 nautical miles from the shoreline at lat. 30°13′40″ N, long. 86°01′50″ W; westerly along a line parallel to the shoreline at a distance of 3 nautical miles to lat. 30°20′10″ N, long. 86°48″00′ W; due N to U. S. Highway No. 98 at lat. 30°24′40″ N, long. 86°48′00″ W; westerly along Highway No. 98 to its intersection with the Navarre-Milton Highway (State Highway No. 87) at lat. 30°24′15″ N, long. 86°52′15″ W; northerly and westerly along State Highway No. 87 to lat. 30°33′40″ N, long. 86°55′15″ W; NE to lat. 30°43′00″ N, long. 86°38′30″ W; E to a point on the S edge of Red Civil Airway No. 30 at lat. 30°43′20″ N, long. 86°32′00″ W; due S to lat. 30°29′00″ N; due E to long. 86°28′00″ W; due N to the S edge of Red Civil Airway No. 30 at lat. 30°43′25″ N, long. 86°28′00″ W; easterly along the boundary of Red Civil Airway No. 30 to lat. 30°43′50″ N, long. 86°10′30″ W, point of beginning.	Unlimited	Continuous	Air Proving Ground, Eglin Field, Valparaiso, Fla.

GEORGIA

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Fort Benning (Birmingham Chart).	Beginning at lat. 32°32′15″ N, long. 84°37′30″ W; S to lat. 32°18′00″ N, northwesterly along the railroad to lat. 32°20′45″ N, long. 84°47′00″ W; southerly along the road to lat. 32°18′00″ N, long. 84°46′30″ W; S along the highway to lat. 32°15′30″ N, long. 84°48′30″ W; due W to long. 84°53′30″ W; SW along the river to lat. 32°14′45″ N, long. 84°55′00″ W; due W to long. 84°57′30″ W; S to lat. 32°18′30″ N, long. 84°57′45″ W; NW along the north bank of the river to lat. 32°18′45″ N, long. 84°58′30″ W; due N to lat. 32°20′16″ N; NE to lat. 32°21′10″ N, long. 84°56′45″ W; due N to lat. 32°22′30″ N, long. 84°56′45″ W; NE along the creek to lat. 32°24′14″ N, long. 84°53′21″ W; northerly to lat. 32°28′10″ N, long. 84°52′20″ W; due N to lat. 32°30′50″ N; easterly along the railroad to lat. 32°32′15″ N, long. 84°37′30″ W, point of beginning.	Surface to 17,000 feet	Continuous	U. S. Army, Fort Benning, Ga.
Hinesville (Jacksonville Chart).	Beginning at lat. 32°05′00″ N, long. 81°38′00″ W; SE to lat. 32°01′00″ N, long. 81°27′30″ W; SW to lat. 31°55′00″ N, long. 81°29′00″ W; SW to lat. 31°51′30″ N, long. 81°36′00″ W; NW to lat. 31°55′00″ N, long. 81°51′30″ W; NE to lat. 32°05′00″ W, long. 81°45′00″ W; E to lat. 32°05′00″ N, long. 81°38′00″ W, point of beginning.	Unlimited	do	Hdq., 3d Army, Fort McPherson, Ga.

IDAHO

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Pocatello (Pocatello Chart)	Beginning at lat. 43°45′00″ N, long. 112°40′00″ W; SW to lat. 43°30′00″ N, long. 112°52′00″ W; to lat. 43°28′00″ N, long. 113°01′00″ W; N to lat. 43°33′00″ N; NE to lat. 43°45′00″ N, long. 112°53′00″ W; E to lat. 43°45′00″ N, long. 112°40′00″ W, point of beginning.	Unlimited	Continuous	Pocatello AFB, Pocatello, Idaho.
Sailor Creek (Boise Chart)	Beginning at lat. 42°51′00″ N, long. 115°40′00″ W; E to long. 115°35′00″ W; S to lat. 42°45′00″ N; E to long 115°10′00″ W; S to lat. 42°33′00″ N; W to long. 115°40′00″ W; N to lat. 42°51′00″ N, long. 115°40′00″ W, point of beginning.	do	Daylight hours only	Idaho Air National Guard, Boise, Idaho.

ILLINOIS

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Glenview (Chicago and Milwaukee Charts).	Beginning at lat. 42°35′00″ N, long. 87°47′30″ W; E to long. 87°33′00″ W; S to lat. 42°08′00″ N; W to long. 87°40′00″ W; N and W along the east and north edge of Red Civil Airway #43 to lat. 42°17′30″ N, long. 87°47′30″ W; N to lat. 42°35′00″ N, long. 87°47′30″ W, point of beginning.	Surface to 16,000 feet	Continuous	NAS, Glenview, Ill.

INDIANA

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Camp Atterbury (Cincinnati Chart).	Beginning at lat. 39°21′30″ N, long. 86°06′00″ W; E to lat. 39°21′30″ N, long. 85°59′30″ W; S to lat. 39°13′00″ N, long. 85°59′30″ W; W to lat. 39°13′00″ N, long. 86°06′00″ W; N to lat. 39°21′30″ N, long. 86°06′00″ W, point of beginning.	Surface to 22,000 feet	Daylight hours only	Joint use by U. S. Army and Indiana Air National Guard.

IOWA

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Elkader (Dubuque Chart)	1 nautical mile radius centered at lat. 42°48′24″ N, long. 91°25′12″ W.	Surface to 2,500 feet	Continuous	Collins Radio Co., Cedar Rapids, Iowa.

KANSAS

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Brookville (Salina Chart).	Beginning at lat. 38°45′20″ N., long. 97°43′55″ W; S to lat. 38°43′00″ N; SW along railroad to lat. 38°38′20″ N, long. 97°47′30″ W; W to long. 97°53′22″ W; N to lat. 38°45′20″ N; to lat. 38°45′20″ N, long. 97°43′55″ W, point of beginning.	Unlimited	Continuous	Smoky Hill AFB, Salina, Kans.
Manhattan (Salina Chart)	Beginning at lat. 39°13′00″ N, long. 96°41′15″ W; to lat. 39°08′30″ N, long. 96°44′30″ W; W to long. 96°47′30″ W; WNW to lat. 39°09′00″ N, long. 96°49′30″ W; to lat. 39°13′00″ N, long. 96°47′30″ W; to lat. 39°13′00″ N, long. 96°41′15″ W, point of beginning.	Surface to 10,000 feet	0700 to 2200 daily	Marshall AFB, Fort Riley, Kans.
Osage City (Kansas City Chart).	Circular area with a radius of 3 miles centered at lat. 38°36′00″ N, long. 95°57′00″ W.	Unlimited	Continuous	Strategic Air Command Offutt AFB, Omaha, Nebr.

KENTUCKY

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Camp Campbell (Nashville Chart).	Beginning at lat. 36°33′00″ N, long. 87°22′00″ W; to long. 87°50′00″ W; N to lat. 36°44′00″ N; E to long. 87°40′00″ W; S to lat. 36°40′00″ N; E to long. 87°27′00″ W; to lat. 36°33′00″ W, long. 87°22′00″ W, point of beginning.	Unlimited	Continuous	U. S. Army, Camp Campbell, Ky
Fort Knox (Nashville Chart).	Beginning at a point at lat. 37°59′00″ N, long. 85°45′00″ W; due S to lat. 37°47′30″ N; due W to long. 85°55′30″ W (Intersection of U. S. Highway 31-W); northerly along U. S. Highway 31-W to lat. 37°50′45″ N, long. 85°57′00″ W (Intersection of U. S. Highway 31-W and Wilson Road); northerly along Wilson Road to lat. 37°58′00″ N, long. 85°57′45″ W (Intersection of Wilson Road and ICRR); northerly along ICRR to lat. 37°59′00″ N, long. 85°57′00″ W (crossing ICRR and L&N RR), northeasterly to lat. 38°01′00″ N, long. 85°54′30″ W (Intersection of L&N RR and Ky. Route #44); easterly along Ky. Route #44, to lat. 38°00′30″ N, long. 85°52′00″ W; due S to lat. 37°59′00″ N; due E to lat. 37°59′00″ N, long. 85°45′00″ W, point of beginning.	Surface to 22,000 feet	do	U. S. Army Armored Center, Fort Knox, Ky.

MAINE

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Great Pond (Lewiston Chart)	Beginning at lat. 44°59′00″ N, long. 68°28′30″ W; to lat. 44°59′40″ N, long. 68°25′00″ W; to lat. 44°57′00″ N, long. 68°24′00″ W; to lat. 44°56′30″ N, long. 68°28′00″ W; to lat. 44°59′00″ N, long. 68°28′30″ W, point of beginning.	Surface to 6,000 feet	Daylight hours only, to October 1, 1949	Dow AFB, Bangor, Maine.

MARYLAND

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Aberdeen (Washington Chart).	Beginning at the town of Aberdeen at lat. 39°30′30″ N, long. 76°10′00″ W; SE to lat. 39°29′00″ N, long. 76°08′00″ W; E to lat. 39°29′30″ N, long. 76°05′00″ W; SE to lat. 39°27′00″ N, long. 76°00′30″ W; SW to lat. 39°19′47″ N, long. 76°11′34″ W; SW to lat. 39°08′57″ N, long. 76°18′47″ W; S to Love Point at lat. 39°02′00″ N, long. 76°18′40″ W; WSW to Sandy Point Light House at lat. 39°00′45″ N, long. 76°23′20″ W; N to lat. 39°09′15″ N, long. 76°24′45″ W; NE to lat. 39°17′30″ N, long. 76°19′45″ W; NW to lat. 39°18′30″ N, long. 76°22′00″ W; N to the town of Chase at lat. 39°22′00″ N, long. 76°22′00″ W; NNW to lat. 39°23′28″ N, long. 76°20′40″ W; NE to lat. 39°26′10″ N, long. 76°14′50″ W; NE to lat. 39°27′00″ N, long 76°12′30″ W; NE to lat. 39°30′30″ N, long. 76°10′00″ W, point of beginning.	Unlimited	Continuous	Edgewood Arsenal, Md.
Assateague Island (Washington and Norfolk Charts).	Beginning at lat. 38°30′00″ N, long. 75°03′00″ W; due east 3 nautical miles to approx. lat. 38°30′00″ N, long. 74°59′00″ W; SW along a line paralleling the coastline to lat. 37°51″25′ N, long. 75°16′50″ W; NW to the coastline at lat. 37°53′00″ N, long. 75°20′00″ W; NW along the coastline to lat. 38°30′00″ N, long. 75°03′00″ W, point of beginning.	do	do	Naval Air Station, Patuxent, Md.
Bloodsworth Island (Chesapeake Bay) (Washington Chart).	Straight lines connecting the following points: lat. 38°13′00″ N, long. 76°00′00″ W; lat. 38°08′00″ N, long. 76°00′00″ W; lat. 38°08′00″ N, long. 76°08′50″ W; lat. 38°13′00″ N, long. 76°11′20″ W.	do	do	CinC Lant. Flt, Norfolk, Va.
Chesapeake Bay (Washington Chart).	Sector of a circle with 17,600 yard radius centered at lat. 38°39′30″ N, long. 76°34′30″ W, between 31° true and 122° true, excluding that portion within the confines of Civil Airways and Sharp's Island Danger Area.	Surface to 20,000 feet	Daylight hours only	Potomac River Naval Command, Washington, D. C.
Chincoteague Bay (Washington Chart).	Circle with radius of 3 miles centered at lat. 38°00′42″ N, long. 75°11′15″ W.	Surface to 10,000 feet	do	CinC Lant. Flt, Norfolk, Va.
Patuxent River (Washington Chart).	(1) Beginning at lat. 38°30′00″ N, long. 75°34′30″ W; southerly following the railroad to lat. 38°22′00″ N, long. 75°36′00″; southeasterly following Maryland State Highway No. 12 to the western edge of Amber Civil Airway No. 9 (approx. lat. 38°18′15″ N, long. 75°32′00″ W; southwesterly following the western edge of Amber Civil Airway No. 9 to lat. 37°45′00″ N, long. 75°56′30″ W; W to the eastern edge of Blue Civil Airway No. 56 (approx. lat. 37°45′00″ N, long. 76°30′00″ W); northwesterly following the eastern boundary of Blue Civil Airway No. 56 to the point of intersection with the western boundary of Red Civil Airway No. 77; northeasterly following the western boundary of Red Civil Airway No. 77 to the south boundary of Red Civil Airway No. 20; southeasterly along southern boundary of Red Civil Airway No. 20 to the eastern boundary of Red Civil Airway No. 77; northeasterly following the eastern boundary of Red Civil Airway No. 77 to lat. 38°30/00″ N, long. 76°03′30″ W; due E to lat. 38°30′00″ N, long. 75°34′30″ W, point of beginning.	3,500 feet to unlimited except portion in Red Civil Airway No. 77 which is surface to 5,000 feet.	Continuous	Patuxent Naval Air Station, Md.
	(2) Beginning at lat. 38°12′20″ N, long. 75°36′10″ N; SW along west boundary of Blue Civil Airway No. 56 to lat. 38°04′50″ N, long. 75°41′50″ W; NW to lat. 38°20′50″ N, long. 76°13′40″ W; NE along the east boundary of Red Civil Airway No. 77 to lat. 38°27′15″ N, long. 76°06′10″ W; SE to lat. 38°12′20″ N, long. 75°36′10″ W, point of beginning.	3,500 feet to unlimited	do	Patuxent Naval Air Station, Md., and Andrews Field, Md
	(3) Beginning at lat. 38°18′26″ N, long. 76°14′30″ W; SE to lat. 38°13′00″ N, long. 76°11′20″ W; E to lat. 76°00′00″ N; S to lat. 38°08′00″ N; W to long. 76°08′00″ W; SE to lat. 37°55′15″ N, long. 76°02′30″ W; SW to lat. 37°52′45″ N, long. 76°11′03″ W; NW to lat. 38°02′20″ N, long. 76°17′24″ W; N to lat. 38°07′41″ N, long. 76°17′25″ W; NW to the east boundary of Red Civil Airway No. 77 (approx. lat. 38°14′30″ N, long. 76°20′45″ W); NE along southern boundary of Red Civil Airway No. 77, to lat. 38°18′10″ N, long. 76°16′10″ W; E to lat. 38°18′26″ N, long. 76°14′30″ W, point of beginning.	Surface to unlimited	do	Patuxent Naval Air Station, Md.
	(4) Circle with radius of 5 nautical miles centered at lat. 37°47′54″ N, long. 76°03′48″ W.	do	do	Do.

MARYLAND—Continued

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Sharps Island (Washington Chart).	Circle with radius of 3¼ miles centered at lat. 38°37'16" N, long. 76°21'56" W.	Surface to 20,000 feet	Daylight hours only	NATC, Patuxent River, Md.
Sinepuxent Bay (Washington Chart).	Circle with radius of 3 miles centered at lat. 38°12'42" N, long. 75°09'00" W.	Surface to 10,000 feet	do	CinC Lant. Flt, Norfolk, Va.
MASSACHUSETTS				
Camp Edwards (Boston Chart.)	(1) Circle with radius of 3 miles centered at lat. 41°43'30" N, long. 70°32'30" W.	Unlimited	Daylight hours only	Dept. of Army, Camp Edwards, Mass.
	(2) Beginning at lat. 41°39'00" N, long. 70°35'00" W: NE to lat. 41°41'00" N, long. 70°33'45" W; clockwise following the perimeter of the already designated Camp Edwards Danger Area to lat. 41°42'10" N, long. 70°35'30" W; SW to lat. 41°39'30" N, long. 70°36'30" W; SE to lat. 41°39'00" N, long. 70°35'00" W, point of beginning.	do	Continuous	Do.
Cotuit (Boston Chart)	A circular area with a radius of 2 miles centered at lat. 41°30'42" N, long. 70°22'24" W.	Surface to 20,000 feet	Daylight hours only.	ComNab, 1st Naval District, Boston, Mass.
Cuttyhunk (Boston Chart).	Straight lines connecting the following points: lat. 41°25'45" N, long. 70°58'21" W; lat. 41°23'54" N, long. 71°01'08" W; lat. 41°21'45" N, long. 70°58'29" W; lat. 41°23'36" N, long. 70°55'44" W.	do	Continuous Nov. 10 to Apr. 30, annually.	Do.
Long Pond (Boston Chart).	Circle with radius of 2 miles centered at lat. 41°46'18" N, long. 70°51'18" W.	do	Daylight hours only, Monday through Friday.	Do.
Monomy Point (Boston Chart).	Circle with radius of 2 miles centered at lat. 41°36'00" N, long. 69°59'00" W.	do	Daylight hours only	ComFair Quo, 1st Naval District, Boston, Mass.
Nashawena (Boston Chart).	A circular area with a radius of 1½ nautical miles centered at lat. 41°27'06" N, long. 70°54'10" W.	do	Daylight hours only, Monday through Friday.	Do.
No Man's Land Island (Boston Chart).	A circular danger area having a radius of 3 miles and centered at lat. 41°15'30" N, long. 70°48'40" W.	Unlimited	Continuous	Do.
North Eastham (Boston Chart).	Circle with a radius of 2 miles centered at lat. 41°51'00" N, long. 70°03'00" W.	Surface to 20,000 feet	Daylight hours only	ComNab, 1st Naval District, Boston, Mass.
Quabbin Reservoir (Albany Chart).	Triangular area with the following coordinates: long. 72°19'00" W, lat. 42°31'00" N; long. 72°15'30" W, lat 42°30'30" N; long. 72°19'00" W, lat. 42°28'30" N.	do	do	ComNab, 1st Naval District, Boston, Mass. (minimum ceiling 8,000 feet, visibility 5 miles).
Wellfleet (Boston Chart)	The area within the sector of a circle with radius of 20,000 yards centered at lat. 41°56'00" N, long. 69°58'30" W, extending clockwise from a bearing of 345° true to a bearing 145° true and away from the center of the circle.	Unlimited	Continuous June 1 to Sept. 30 annually.	Hqs., 1st Army Area, Governors Island, N. Y.
Westport Point (Boston Chart).	A circular area with radius of 1½ nautical miles centered at lat. 41°28'12" N, long. 71°01'42" W.	Surface to 20,000 feet	Continuous	ComNab, 1st Naval District, Boston, Mass.
Woods Hole (Boston Chart).	Circle with radius of 2 miles centered at lat. 41°31'06" N, long. 70°44'06" W.	do	Daylight hours only Monday through Friday.	Do.
MICHIGAN				
Grayling (Green Bay Chart)	Area I: N boundary: lat. 44°41'00" N; E boundary: long. 84°46'00" W; S boundary: lat. 44°36'00' N; W boundary: long. 84°53'00" W. Area II: N boundary: lat. 44°54'00" N; E boundary: long. 84°31'00" W; S boundary: lat. 44°41'00" N; W boundary: long. 84°40'00" W.	Surface to 20,000 feet	Continuous, Aug. 6 to Aug. 20. inclusive, 1949.	Michigan National Guard, Kellogg Field, Battle Creek Mich.
Lower Lake Huron (Summer Area) (Detroit Chart).	Beginning at lat. 43°52'00" N, long. 82°32'00" W; due E to long. 82°21'00" W; SSE to lat. 43°34'30" N, long. 82°18'00" W; SSW to lat. 43°16'00" N, long. 82°22'30" W; due W to long. 82°26'30" W; NNW to lat. 43°52'00" N, long. 82°32'00" W, point of beginning.	Unlimited	Daylight hours Apr. 1 through Nov. 30, annually.	Selfridge AFB, Mount Clemens, Mich.
Lower Lake Huron (Winter Area) (Detroit Chart).	Beginning at lat. 43°49'30" N, long. 82°27'00" W; southerly to lat. 43°13'00" N, long. 82°20'00" W; westerly to shoreline at lat. 43°12'00" N, long. 82°30'00" W; northerly along the shoreline to lat. 43°49'00" N, long. 82°37'30" W; easterly to lat. 43°49'30" N, long. 82°27'00" W, point of beginning.	do	Daylight hours Dec. 1 through Mar. 31, annually.	Do.
Oscoda (Green Bay Chart).	N boundary: 44°35'00" N; E boundary: 83°23'00" W; S boundary: 44°27'00" N; W boundary: 83°39'00" W.	do	Daylight hours only	Do.
Upper Lake Huron (Green Bay Chart)	Beginning at lat. 44°55'00" N, long. 83°15'00" W; due E to long. 82°52'00" W; southerly to lat. 44°11'00" N, long. 82°58'00" W; due W to long. 83°21'00" W; northerly to a point one mile offshore due E of Au Sable Point; northerly paralleling the shoreline at a distance of one mile to a point due E of Sturgeon Point; due N to lat. 44°55'00" N, long. 83°15'00" W, point of beginning.	do	do	Do
MINNESOTA				
Camp Ripley (Duluth Chart)	Beginning at lat. 46°10'30" N, long. 94°26'00" W; due E to long. 94°21'00" W; due S to lat. 46°09'55" N; due W to long. 94°26'00" W; due N to lat. 46°10'30" N, long. 94°26'00" W, point of beginning.	Surface to 30,000 feet	Continuous, June 11 to Aug. 7, inclusive, 1949.	Minnesota, North Dakota, and South Dakota National Guard, St. Paul, Minn.
Grand Marais (Duluth Chart).	Beginning at lat. 47°37'45" N, long. 90°30'05" W; SE to lat. 47°30'50" N, long. 90°21'30" W; SW to lat. 47°10'17" N, long. 90°58'20" W; NW to lat. 47°17'35" N, long. 91°07'10" W; NE to lat. 47°37'45" N, long. 90°30'05" W, point of beginning.	Unlimited	Daylight hours only	Organized Naval Air Reserve Squadrons, Naval Air Station (Wold Chamberlain Field), Minneapolis, Minn.
Upper Red Lake (Lake of Woods Chart).	N boundary: lat. 48°30'00" N; S boundary: lat. 48°08'00" N; E boundary: long. 94°35'00" W; W boundary: long. 95°10'00" W.	do	do	Naval Air Station (Wold Chamberlain Field), Minneapolis, Minn.
MISSISSIPPI				
Pearl River (New Orleans Chart).	Circular area with a 5 mile radius centered at lat. 30°23'00" N, long. 89°34'00" W.	Unlimited	0800 to 1630 daily	Naval Air Station, New Orleans, La.
MISSOURI				
Fort Leonard Wood (Tulsa Chart).	Beginning at lat. 37°48'15" N, long. 92°02'00" W; S to lat. 37°43'00" N; to lat. 37°42'00" N, long. 92°06'00" W; S to lat. 37°38'30" N; to lat. 37°36'30" N, long. 92°11'00" W; to lat. 37°36'15" N, long. 92°15'30" W; N to lat. 37°40'30" N, to lat. 37°42'00" N, long. 92°14'30" W; to lat. 37°48'15" N, long. 92°04'00" W; to lat. 37°48'15" N, long. 92°02'00" W, point of beginning.	Surface to 10,000 feet	Daylight hours only	Naval Air Station, Lambert Field, St. Louis, Mo.

MONTANA

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Dillon (Yellowstone Park chart).	N boundary: latitude 45°07′30″ N. E boundary: longitude 112°55′00″ W. S boundary: latitude 45°00′00″ N. W boundary: longitude 113°10′00″ W.	Surface to 18,000 feet	Daylight hours only, June 12 through June 26, 1949.	Montana National Guard, Helena, Mont.

NEVADA

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Black Rock Desert (Elko Chart).	Beginning at lat. 40′25′00″ N, long. 118°40′00″ W; S to lat. 41°22′30″ N; E to long. 118°39′30″ W; S to lat. 41°12′00″ N; W to long. 118°42′30″ W; S to lat. 40°57′30″ N, long. 118°43′00″ W; W to long. 118°47′00″ W; S to lat. 40°55′00″ N, WSW to lat. 40°54′00″ N, long. 118°55′00″ W; SW to lat. 40°47′00″ N, long. 119°11′30″ W; N to lat. 40°57′30″ N, E to long. 119°04′00″ W; NE to lat. 41°25′00″ N, long. 118°45′30″ W; E to lat. 40°25′00″ N, long. 118°40′00″ W. point of beginning.	Surface to 30,000 feet	Daylight hours only	Naval Air Station Alameda, Calif.
Fallon (Reno Chart)	(1) Beginning at lat. 39°46′00″ N, long. 118°44′00″ W; to lat. 39°56′30″ N, long. 118°12′00″ W; to lat. 39°38′00″ N, long. 118°22′40″ W; W to long. 118°44′00″ W; to lat. 39°46′00″ N, long. 118°44′00″ W, point of beginning.	do	Continuous	12th Naval District, San Diego, Calif.
	(2) Target No. 17: A circular area having a radius of 5 miles centered at lat. 39°15′00″ N, long. 118°49′00″ W.	Surface to 15,000 feet	do	Do.
	(3) Target No. 18: A circular area having a radius of 5 miles centered at lat. 39°20′00″ N, long. 118°49′00″ W.	do	do	Do.
	(4) Target No. 19: A circular area having a radius of 5 miles centered at lat. 39°09′00″ N, long. 118°36′45″ W.	do	do	Do.
Tonopah (Mount Whitney Chart).	Beginning at lat. 37°53′00″ N, long. 116°11′00″ W; S to lat. 37°42′00″ N; E to long. 115°53′00″ W; S to lat. 37°33′00″ N; E to long. 115°48′00″ W; S to lat. 37° 17′00″ N; E to long. 115°18′00″ W; S to lat. 36°41′00″ N; W to long. 115°35′30″ W; S to lat. 36°35′00″ N; W to long. 115°42′00″ W; N to lat. 36°41′00″ N; W to long. 116°26′30″ W; N to lat. 36°51′00″ N; W to long. 116°33′30″ W; N to lat. 37°33′00″ N; W to long. 117°02′00″ W; northerly to lat. 37°53′00″ N, long. 117°01′00″ W; E to lat. 37°53′00″ N, long. 116°11′00″ W, point of beginning.	Surface to 30,000 feet	Daylight hours only	Las Vegas Air Force Base, Nev.

NEW HAMPSHIRE

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Isles of Shoals (Boston Chart).	Straight lines connecting the following: lat. 42°59′54″ N, long. 70°38′21″ W; lat. 43°02′21″ N, long. 70°37′14″ W; lat. 43°01′30″ N, long. 70°33′49″ W; lat. 42°59′03″ N, long. 70°35′00″ W.	Surface to 20,000 feet	Daylight hours only	Squantum Naval Air Station, Mass.
New Boston (Boston Chart).	N boundary: lat. 42°57′15″ N; S boundary: lat. 42°55′00″N; E boundary: long. 71°36′30″ W; W boundary: 71°39′30″ W.	do	do	1st Naval District Boston, Mass.

NEW JERSEY

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Fort Dix (New York and Washington Charts).	Beginning at lat. 40°02′45″ N, long. 74°25′50″ W; to lat. 39°56′45″ N, long. 74°24′00″ W; along a railroad to lat. 39°56′00″ N, long. 74°26′00″ W; to lat. 39°57′20″ N, long. 74°27′40″ W; along a road to lat. 39°57′20″ N, long. 74°33′30″ W; N to lat. 40°02′45″ N; E to lat. 40°02′45″ N, long. 74°25′50″ W, point of beginning.	Unlimited	Continuous	U. S. Army, Fort Dix, N. J.
Great Bay (Washington Chart).	A circular area having a radius of 3 nautical miles centered at lat. 39°27′48″ N, long. 74°18′35″ W.	Surface to 10,000 feet	Daylight hours only	Naval Air Station, Atlantic City, N. J.
New Gretna (Washington Chart).	Circle with radius of 3 nautical miles centered at lat. 89°34′30″ N, long. 74°24′30″ W.	do	do	4th Naval District, Philadelphia, Pa.
Oceanville (Washington Chart).	Circle with radius of 3 miles centered at lat. 39°26′48″ N, long. 74°24′00″ W.	Surface to 20,000 feet	do	Do.

NEW MEXICO

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Albuquerque (Albuquerque Chart).	Beginning at lat. 34°56′00″ N, long. 106°55′00″ W; SE to lat. 34°45′00″ N, long. 106°50′00″ W; due W to long. 107°15′00″ W; due N to lat. 34°52′00″ N; NE to lat. 34°56′30″ N, long. 107°03′00″ W; E to lat. 34°56′00″ N, long. 106°55′00″ W, point of beginning.	Surface to 30,000 feet	Continuous	Kirtland AFB, Albuquerque N. Mex.
Deming (Roswell Chart)	Straight lines connecting the following: lat. 82°23′35″ N. long. 107°04′00″ W; lat. 32°23′35″ N, long. 107°08′10″ W; lat. 32°20′15″ N, long. 107°08′10″ W; lat. 32°20′15″ N, long. 107°04′00″ W.	800 to 25,000 feet	0700 to 1800 Monday through Friday.	Biggs Air Force Base, El Paso, Tex.
Guadalupe Mountains (Roswell Chart).	N boundary: lat. 32°18′00″ N; E boundary: long. 104°52′00″ W; S boundary: lat. 32°00′00″ N; W boundary: long. 105°33′00″ W.	Surface to 45,000 feet	Continuous	8th Air Force, Carswell AFB, Fort Worth, Tex.
White Sands Proving Grounds (Alamogordo) (Roswell Chart).	Beginning at lat. 82°00′00″ N. long. 106°34′00″ W; N to lat. 32°29′00″N, long. 106°34′00″ W; NW to lat. 32°50′00″ N, long. 106°46′00″ W; N to lat 33°50′15″ N, long. 106°46′00″ W; E to lat. 33°50′15″ N, long. 106°03′50″ W: S to lat. 32°55′00″ N, long. 106°03′50″ W; W to lat. 82°55′00″ N, long. 106°06′00″ W; S to lat. 32°22′00″ N, long. 106°06′00″ W; SW to lat. 32°00′00″ N, long. 106°19′30″ W; W to lat. 32°00′00″ N, long. 106°34′00″ W, point of beginning.	Unlimited	do	Holloman Air Force Base, Alamogordo, N. Mex.

NEW YORK

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Albany (Albany Chart)	Straight lines connecting the following points: lat. 43°48′15″ N, long. 74°15′30″ W; lat. 43°20′00″ N, long. 74°00′10″ W; lat. 43°08′40″ N, long. 74°39′00″ W; lat. 43°37′00″ N, long. 74°54′40″ W.	Unlimited	Continuous	Air Matériel Command, Newark, N. J., Airport.
Gardiner's Island (New York Chart).	A circular area with a radius of 3 nautical miles centered at lat. 41°08′30″ N, long. 72°08′50″ W.	do	Daylight hours only	Naval Air Station, Quonset Point, R. I.
Lake Ontario (Detroit Chart).	Beginning at lat. 43°18′40″ N, long. 78°51′30″ W; due N to lat. 43°20′00″ N; due W to long. 78°55′00″ W; SE to lat. 43°18′30″ N, long. 78°51′00″ W: E to lat. 43°18′40″ N, long. 78°51′30″ W, point of beginning.	Surface to 2,000 feet	Daylight hours only, June 1 to July 30, 1949.	Cornell Aeronautical Laboratory, Buffalo, N. Y.
Pine Camp (Burlington and Albany Charts).	Beginning at lat. 44°15′00″ N, long. 75°31′30″ W; to lat. 44°11′15″ N, long. 75°25′00″ W; to lat. 44°00′30″ N, long. 75°35′30″ W; to lat. 44°02′15″ N, long. 75°50′15″ W, to point of beginning.	Unlimited	Continuous	Hdq., 1st Army, Governor's Island, N. Y.

NEW YORK—Continued

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
West Point (U. S. Military Academy) (New York Chart).	Beginning at lat. 41°19′40″ N, long. 74°03′33″ W; to a distance of approx. 2.84 miles on a bearing of 90° true to lat. 41°19′40″ N, long. 74°00′26″ W; to a distance of approx. 1.12 miles on a bearing of 0° true to lat. 41°20′40″ N, long. 74°00′26″ W; to a distance of approx. 1.12 miles on a bearing of 90° true to lat. 41°20′40″ N, long. 73°58′58″ W; to a distance of approx. 2.3 miles on a bearing of 0° true to lat. 41°22′40″ N, long. 73°58′58″ W, which point is on the W edge of U. S. Highway No. 9W; in a northwesterly direction along the west side of U. S. Highway No. 9W, to lat. 41°23′08″ N, long. 73°59′42″ W; to a distance of approx. .35 miles on a bearing of 270° true to lat. 41°23′08″ N, long. 74°00′00″ W, which point is on the east edge of New York State Highway No. 293, thence in a southwesterly direction along the east side of New York State Highway No. 293 to lat. 41°20′40″ N, long. 74°03′33″ W; to a distance of approx. 1.17 miles ou a bearing of 180° true to the point of beginning.	Surface to 4,000 feet	Daylight hours only, Mar. 1 through Nov. 1 annually.	U. S. Military Academy, West Point, N. Y.

NORTH CAROLINA

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Albemarle Sound (Norfolk Chart).	(1) Circle with 3 mile radius centered at lat. 36°01′00″ N, long. 76°27′00″ W.	Surface to 20,000 feet	Daylight hours only	CinC Lant Flt, Norfolk, Va.
	(2) Circle with 3 mile radius centered at lat. 36°03′30″ N, long. 76°23′36″ W.	do	do	Do.
	(3) Circle with 3 mile radius centered at lat. 36°03′30″ N, long. 76°20′00″ W.	do	do	Do.
	(4) Circle with 3 mile radius centered at lat. 36°06′46″ N, long. 76°08′35″ W.	do	do	Do.
	(5) Circle with 3 mile radius centered at lat. 36°07′55″ N, long. 76°03′40″ W.	do	do	Do.
	(6) Circle with 3 mile radius centered at lat. 35°58′44″ N, long. 76°21′34″ W.	do	do	Do.
	(7) Circle with 3 mile radius centered at lat. 35°59′16″ N long. 76°15′58″ W.	do	do	Do.
	(8) Circle with 3 mile radius centered at lat. 36°00′05″ N, long. 76°10′54″ W.	do	do	Do.
	(9) Circle with 3 mile radius centered at lat. 36°00′33″ N, long. 76°05′58″ W.	do	do	Do.
Bogue Sound (Norfolk Chart).	(1) Circle with 3 mile radius centered at lat. 34°41′00″ N, long. 76°57′00″ W.	Surface to 10,000 feet	do	Marine Corps Air Station, Cherry Point, N. C.
	(2) Circle with 3 mile radius centered at lat. 34°42′00″ N, long. 77°01′00″ W.	do	do	Do.
Camp Le Jeune (Norfolk Chart).	Beginning at a point 3 nautical miles from the U. S. Shoreline at lat. 34°38′40″ N, long. 76°44′00″ W; southwesterly 3 nautical miles from and paralleling the Shoreline to the northeastern boundary of the Control Area via the SE course of Wilmington, N. C. radio range, at approximate lat. 34°15′45″ N, long. 77°39′20″ W; northwest to lat. 34°19′00″ N, long. 77°43′30″ W; to lat. 34°37′00″ N, long. 77°29′00″ W; to lat 34°42′00″ N, long. 77°23′40″ W; due east to long. 76°46′00″ W; SSE to a point 3 nautical miles from the U. S. Shoreline at lat. 34°38′40″ N, long. 76°44′00″ W, point of beginning.	Unlimited	Continuous	Navy Department, Camp Le Jeune, N. C., Cherry Point, N. C., Camp Davis, N. C.
Cherry Point (Norfolk Chart) (Area I).	Beginning at a point three nautical miles from the U. S. Shoreline at approximate lat. 35°06′00″ N, long. 75°50′40″ W; southwesterly 3 nautical miles from and parallel to the Shoreline to approximate lat. 34°54′30″ N, long. 76°08′45″ W; due W to a point on the Shoreline at long. 76°18′30″ W; along the shoreline to lat. 84°42′30″ N, long. 76°57′30″ W; to lat 34°42′00″ N, long. 76°57′45″ W; due west to long. 77°23′40″ W; southwest to lat. 33°21′30″ N, long. 77°41′40″ W; clockwise along the arc of a circle with a radius of 60 miles centered at lat. 34°54′30″ N, long. 76°53′00″ W; to lat. 35°06′00″ N, long. 75°50′40″ W, point of beginning.	10,000 to 18,000 feet	Sunset to sunrise daily	Marine Corps Air Station, Cherry Point, N. C.
Cherry Point (Area II) (Norfolk Chart).	Beginning at a point 3 nautical miles from the U. S. Shoreline at lat. 34°54′30″ N, long. 76°08′45″ W; southwesterly and westerly 3 nautical miles from and parallel to the Shoreline to approximate lat. 34°38′40″ N, long. 76°44′00″ W; north-northwest to a point on the Shoreline at lat. 34°42′00″ N, long. 76°46′00″ W; west to long. 76°57′45″ W; to lat. 34°42′30″ N, long. 76°57′30″ W; along the Shoreline to lat. 34°54′30″ N, long. 76°18′30″ W; to lat. 34°54′30″ N, long. 76°08′45″ W, point of beginning.	Surface to 18,000 feet	do	Do.
Core Sound (Norfolk Chart).	Circle with radius of 3 miles centered at lat. 34°53′20″ N, long. 76°21′20″ W.	Surface to 10,000 feet	Daylight hours only	Do.
Currituck Sound (Norfolk Chart).	(1) Circle with 3 mile radius centered at lat. 36°31′00″ N, long. 76°01′40″ W.	Surface to 20,000 feet	do	CinC Lant Flt, Norfolk, Va.
	(2) Circle with 3 mile radius centered at lat. 36°27′16″ N, long. 75°56′30″ W.	do	do	Do.
	(3) Circle with 3 mile radius centered at lat. 36°25′24″ N, long. 75°50′09″ W.	Surface to 10,000 feet	do	Do.
	(4) Circle with 3 mile radius centered at lat. 36°10′28″ N, long. 75°45′04″ W.	do	do	Do.
	(5) Circle with 3 nautical mile radius centered at lat. 36°12′15″ N, long. 75°45′57″ W.	do	do	Naval Air Station, Norfolk, Va.
Fort Bragg (Charlotte Chart).	Beginning at lat. 35°10′46″ N, long. 79°01′56″ W; southerly to lat. 35°08′47″ N, long. 79°02′00″ W; southerly to lat. 35°07′00″ N, long. 79°02′30″ W, due S to lat. 35°03′00″ N, due W to long. 79°15′09″ W; northwest to lat. 35°06′49.5″ N, long. 79°24′00″ W; north northeast to lat. 35°09′00″ N, long. 79°23′10.5″ W; northeasterly along Little River to lat. 35°10′46″ N, long. 79°01′56″ W, point of beginning.	Surface to 40,000 feet	Continuous	U. S. Army, Fort Bragg, N. C.
Hog Island (Norfolk Chart).	A radius of 3 miles centered at lat. 34°59′00″ N, long. 76°16′00″ W.	Surface to 10,000 feet	Daylight hours only	Marine Corps Air Station, Cherry Point, N. C.
Kitty Hawk (Norfolk Chart).	Circle with radius of 3 miles centered at lat. 36°02′42″ N long. 75°48′21″ W.	Surface to 20,000 feet	do	CinC Lant Flt, Norfolk, Va.
North Carolina Coastal (Norfolk Chart).	Beginning at the Shoreline at lat. 36°00′00″ N, long. 75°39′00″ W; east to long. 75°34′10″ W, in a southerly direction 3 nautical miles east of and parallel to the Shoreline to lat. 35°15′30″ N, long. 75°26′40″ W; west to long. 75°30′50″ W; in northerly direction along the Shoreline to lat. 36°00′00″ N, long. 75°39′00″ W, point of beginning.	Unlimited	Continuous	Do.
Virginia Capes (North Carolina Coastal Area) Norfolk Chart).	Beginning on the North Carolina Shoreline at lat. 36°33′10″ N, long. 75°52′00″ W; east to long. 75°48′00″ W; in a southeasterly direction 3 nautical miles of and parallel to the shoreline to lat. 36°00′00″ N, long. 75°34′10″ W; west to long. 75°39′00″ W; in a northwesterly direction along the shoreline to lat. 36°33′10″ N, long. 75°52′00″ W, point of beginning.	do	do	Do.
Wanchese (Norfolk Chart).	Circle with radius of 3 miles centered at lat. 35°51′44″ N, long. 75°34′47″ W.	Surface to 20,000 feet	Daylight hours only	Do.

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
OHIO				
Camp Perry (Lacarne) (Cleveland Chart).	Beginning at a point on the S shore of Lake Erie in the vicinity of Locust Point at lat. 41°36′27″ N, long. 83°05′19″ W; NW to lat. 41°45′14″ N, long. 83°12′18″ W; NE to lat. 41°45′15″ N, long. 83°11′23″ W; NE to lat. 41°48′58″ N, long. 83°05′54″ W; SE along the SW edge of Red Airway No. 21 to lat. 41°39′15″ N, long. 82°56′00″ W; SW to lat. 41°38′36″ N, long. 82°56′49″ W; SE to lat. 41°35′31″ N, long. 82°54′47″ W; SW to lat. 41°33′15″ N, long. 83°01′30″ W; NW along the shore line of Lake Erie to lat. 41°36′27″ N, long. 83°05′19″ W, point of beginning, excluding that portion that falls within the confines of Green Civil Airway No. 3.	Surface to 65,000 feet	Daylight hours only	Commanding Officer, Camp Perry, Ohio.
Lacarne (Lake Erie) (Cleveland Chart).	Beginning at lat. 41°49′00″ N, long. 83°05′50″ W; southeast to lat. 41°41′20″ N, long. 82°58′30″ W; southwest to lat. 41°33′40″ N, long. 83°01′30″ W; northwest to lat. 41°33′50″ N, long. 83°03′00″ W; northwest to lat. 41°46′45″ N, long. 83°11′20″ W; southeast to lat. 41°49′00″ N, long. 83°05′50″ W, point of beginning.	do	do	Erie Ordnance Depot, Lacarne, Ohio
Sandusky (Wright Field) (Cleveland Chart).	Beginning at lat. 41°50′00″ N, long. 83°06′45″ W; southeast to lat. 41°36′15″ N, long. 82°53′30″ W; southwest to lat. 41°33′25″ N, long. 82°58′00″ W; northwest to lat. 41°33′45″ N, long. 83°02′30″ W; northwest to lat. 41°39′30″ N, long. 83°15′15″ W; northwest to lat. 41°45′30″ N, long. 83°19′45″ W; northeast to lat. 41°50′00″ N, long. 83°06′45″ W, point of beginning.	do	do	Joint use by Armament Laboratory and Flight Test Division Wright and Patterson Fields, Ohio, and Naval Air Station, Grosse Ile, Mich.
Wilmington (Huntington Chart).	Beginning at lat. 39°41′00″ N, long. 83°01′30″ W; S to lat. 38°48′40″ N, long. 83°02′30″ W; NW to lat. 39°11′20″ N, long. 84°00′00″ W; N to lat. 39°42′10″ N; E to lat. 39°41′00″ N, long. 83°01′30″ W, point of beginning.	Unlimited	Continuous	Air Force All Weather Flying Center, Clinton County Air Force Base, Wilmington, Ohio.
OKLAHOMA				
Fort Sill (Oklahoma City Chart).	Beginning at lat. 34°47′00″ N, long. 98°17′00″ W; S to lat. 34°38′00″ N; W to long. 98°22′00″ W; N to lat. 34°43′00″ N; to lat. 34°44′00″ N, long 98°21′00″ W; N to lat. 34°47′00″ N; E to lat. 34°47′00″ N, long. 98°17′00″ W, point of beginning.	Surface to 45,000 feet	Continuous	Fort Sill Artillery School, Fort Sill, Okla.
Do	Area 11: N boundary: lat. 34°47′00″ N; E boundary: long. 98°21′00″ W; S boundary: lat. 34°38′00″ N; W boundary: long. 98°24′00″ W.	Unlimited	Continuous, June 14 to June 22, 1949, inclusive.	Do.
Lawton (Oklahoma City Chart).	Beginning at lat. 34°43′00″ N, long. 98°24′00″ W; S to lat. 34°38′00″ N; W to long. 98°36′00″ W; N to lat. 34°39′00″ N; W to long. 98°46′00″ W; N to lat. 34°47′00″ N; E to long. 98°38′00″ W; S to lat. 34°44′00″ N; E to long. 98°36′00″ W; S to lat. 34°43′00″ N; E to lat. 34°43′00″ N, long. 98°24′00″ W, point of beginning.	Surface to 45,000 feet	Continuous	Do
PENNSYLVANIA				
Indiantown Gap (New York Chart).	Straight lines connecting the following: lat. 40°23′30″ N, long. 76°45′00″ W; lat. 40°25′10″ N, long. 76°45′00″ W; lat. 40°29′00″ N, long. 76°36′00″ W; lat. 40°26′00″ N, long. 76°32′00″ W.	Surface to 18,000 feet	Continuous	Hdq., 2nd Army, Fort Meade, Md.
RHODE ISLAND				
Block Island Sound (Boston and New York Charts).	Beginning at lat. 41°18′07″ N, long. 70°48′40″ W; counterclockwise around the No Man's Land Danger Area to lat. 41°12′52″ N, long. 70°48′40″ W; westerly to lat. 41° 10′00″ N, long. 71°30′00″ W; due N to lat. 41°16′30″ N; ENE to lat. 41°18′30″ N, long. 71°20′00″ W; easterly to lat. 41°18′07″ N, long. 70°48′40″ W, point of beginning.	Unlimited	Continuous	ComNab, 1st Naval District, Boston, Mass.
Cormorant Rock (Boston Chart).	Circle with radius of 2 nautical miles centered at lat. 41°27′42″ N, long. 71°14′54″ W.	Surface to 20,000 feet	Daylight hours only Monday through Friday.	Comdr. NAB 1st Naval District, Boston, Mass.
Jamestown (Boston Chart).	Circular area with a radius of 1½ nautical miles centered at lat. 41°30′12″ N, long. 71°24′00″ W.	Surface to 10,000 feet	Daylight hours only.	Naval Air Station, Quonset Point, R. I.
Warwick (Boston Chart)	Circle with radius of 1½ nautical miles centered at lat. 41°41′00″ N, long. 71°19′30″ W.	Surface to 20,000 feet	Daylight hours only Monday through Friday.	Comdr. NAB 1st Naval District, Boston, Mass.
SOUTH CAROLINA				
Fort Jackson (Charlotte and Savannah Charts).	Beginning at lat. 34°03′51″ N, long. 80°42′12″ W; southerly to lat. 34°01′40″ N, long. 80°42′15″ W; westerly to lat. 34°01′20″ N, long. 80°54′50″ W; NW to lat. 34°02′21″ N, long. 80°56′02″ W; NE to lat. 34°04′45″ N, long. 80°53′02″ W; NE to lat. 34°06′19″ N, long. 80°48′47″ W; easterly to lat. 34°05′58″ N, long. 80°46′05″ W; SE to lat. 34°03′51″ N, long. 80°42′12″ W, point of beginning.	Surface to 30,000 feet	0700 to 1800 daily	Commanding Officer, Fort Jackson, S. C.
SOUTH DAKOTA				
Newell (Rapid City Chart).	N boundary: lat. 44°44′30″ N, E boundary: long. 102°59′00″ W. S boundary: lat. 44°40′45″ N, W boundary: long. 103°04′25″ W.	Unlimited	Continuous	Rapid City Air Force Base, Rapid City, S. Dak.
Scenic (Caspar Chart)	N boundary: lat. 43° 41′00″ N, E boundary: long. 102° 01′ 00″ W, S boundary: lat. 43°30′00″ N, W boundary: long. 102° 50′ 00″ W.	Surface to 14,000 feet	do	Kearney AFB, Nebr., and Rapid City AFB, N. Dak.
TEXAS				
Camp Hood (Austin Chart).	Beginning at lat. 31°24′00″ N, long. 97°37′45″ W; due S to lat. 31°07′15″ N; due W to long. 97°45′00″ W; due S to lat. 31°00′00″ N; due W to long. 97°54′00″ W; due N to lat. 31°07′15″ N; thence on a bearing of 22°30′ true to lat. 31°24′00″ N, long. 97°46′40″ W; due E to lat. 31°24′00″ N, long. 97°37′45″ W, point of beginning.	Surface to 11,000 feet	0700 to 1700, Monday through Saturday.	2d Armored Division, Camp Hood, Tex.
Corpus Christi (Corpus Christi and San Antonio Charts).	Beginning at lat. 27°49′20″ N, long. 97°00′00″ W; southerly 8 miles offshore to lat. 26°45′00″ N, long. 97°17′00″ W; W to long. 97°36′00″ W; NW to lat. 27°20′00″ N, long. 97°48′00″ W; N to lat. 27°26′30″ N; NE to lat. 27°47′00″ N, long. 97°20′00″ W; to lat. 27°50′00″ N, long. 97°07′00″ W; E to lat. 27°49′20″ N, long. 97°00′00″ W, point of beginning.	Unlimited	Continuous	Naval Air Station, Corpus Christi, Tex.

TEXAS—Continued

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Corpus Christi (Corpus Christi Chart).	A circular area with a radius of 4 miles centered at lat. 27°38′45″ N, long. 97°32′50″ W, excluding any portion which overlaps Blue Civil Airway No. 50.	Surface to 25,000 feet	Daylight hours only	Naval Air Station, Corpus Christi, Tex.
Five points (Dallas Chart)	A circular area with a radius of 3 miles centered at lat 32°37′10″ N, long. 97°08′00″ W.	Unlimited	do	Naval Air Station, Dallas, Tex.
Matagorda Island (San Antonio Chart).	Beginning at Matagorda Island at lat. 28°20′00″ N, long. 96°25′20″ W; to lat. 28°12′40″ N, long. 96°20′00″ W; to lat. 27°58′00″ N, long. 96°44′00″ W; to lat. 28°05′00″ N, long. 96°50′00″ W; northeasterly along outer shoreline of Matagorda Island to lat. 28°20′00″ N, long. 96°25′20″ W, point of beginning, excluding the portion which lies beyond the 3 nautical mile limit of the shoreline.	do	do	Randolph Air Force Base, San Antonio
Midland (El Paso and Roswell Charts).	Target #14: An area 3 miles square centered at lat. 31°43′42″ N, long. 102°12′11″ W. Target #21: An area 3 miles square centered at lat. 31°30′12″ N, long. 102°02′11″ W.	do	do	Roswell Air Force Field, Roswell, N. Mex.

UTAH

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Carrington Island (Salt Lake City Chart).	A circular area with a radius of 3 miles centered at lat. 41°00′30″ N, long. 112°34′30″ W.	Surface to 40,000 feet	Continuous	15th Air Force, Wendover, Utah.
Wendover (Salt Lake City, Grand Junction, and Elko Charts).	Area I: Beginning at lat. 41°11′30″ N, long. 113°56′00″ W; to lat. 40°47′00″ N, long. 113°52′00″ W; W to long. 114°03′00″ W; N to lat. 41°11′30″ N; to lat. 41°11′30″ N, long. 113°56′00″ W, point of beginning.	do	do	Wendover Air Force Base, Wendover, Utah.
	Area II: Beginning at lat. 41°11′30″ N, long. 112°56′30″ W; S to lat. 40°49′15″ N, to lat. 40°47′30″ N, long. 113°40′00″ W; to lat. 41°11′30″ N, long. 113°43′30″ W; to lat. 41°11′ 30″ N, long. 112°56′30″ W, point of beginning.	do	do	Do.
	Southern Area: Beginning at lat. 40°40′30″ N, long. 113°00′00″ W; S to lat. 40°20′00″ N; E to long. 112°40′00″ W; S to lat. 39°45′00″ N; W to long. 112°48′00″ W; to lat. 39°02′00″ N, long. 112°48′00″ W; SW along west boundary of Amber Civil Airway No. 2 to lat. 38°34′00″ N, long. 113°02′30″ W; thence counterclockwise around the arc of a circle with a radius of 10 miles centered at lat. 38°25′30″ N, long. 113°01′00″ W; to lat. 38°27′00″ N, long. 113°12′00″ W; northwesterly along Highway No. 21 to lat. 38°35′00″ N, long. 113°48′00″ W; N to lat. 40°00′00″ N; W to long. 114°00′00″ W; N to lat. 40°20′00″ N; W to long. 114°08′00″ W; N to lat. 40°26′00″ N; E to long. 114°00′00″ W; to lat. 40°38′30″ N, long. 114°00′00″ W; to lat. 40°40′30″ N, long. 113°00′00″ W, point of beginning.	do	do	Do.

VERMONT

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Underhill (Burlington Chart).	Beginning at lat. 44°30′15″ N, long. 72°51′30″ W; to lat. 44°27′00″ N, long. 72°50′00″ W; to lat. 44°27′30″ N, long. 72°53′15″ W; to lat. 44°28′30″ N, long. 72°56′50″ W; to lat. 44°30′00″ N, long. 72°56′30″ W; to lat. 44°30′15″ N, long. 72°51′30″ W, point of beginning.	Surface to 10,000 feet	Continuous June 1 through Sept. 30 annually.	67th Wing National Guard, Otis AFB, Falmouth, Mass., and Grenier AFB, Manchester, N. H.

VIRGINIA

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Camp A. P. Hill (Washington Chart).	Beginning at lat 38°07′30″ N, long. 77°07′00″ W; SSW to lat. 38°02′50″ N, long. 77°08′00″ W; westerly following the county road to lat. 38°00′25″ N, long. 77°16′30″ W; NW to lat. 38°02′45″ N, long. 77°20′20″ W; NE to lat. 38°10′30″ N, long. 77°16′20″ W; thence southeasterly along U. S. Highway No. 17 to lat. 38°07′30″ N, long. 77°07′00″ W, point of beginning.	Surface to 22,000 feet	Continuous	Camp A. P. Hill Military Reservation, Va.
Camp Pickett (Norfolk Chart).	Beginning at lat. 37°04′30″ N, long. 77°54′00″ W; along Highway No. 40 to lat. 37°03′30″ N, long. 77°50′00″ W, due S to lat. 37°01′00″ N, long. 77°50′00″ W; along Amber Civil Airway No. 7 to lat. 36°59′30″ N, long. 77°51′30″ W; W along a creek to lat. 36°59′00″ N, long. 77°55′30″ W; due N to lat. 37°02′15″ N, long. 77°55′30″ W; thence counterclockwise around Blackstone AAF Control Zone to point of beginning.	do	do	Joint use: CinC Lant Flt, Norfolk, Va., and Hq., 2d Army, Fort Meade, Md.
Chincoteague Inlet (Washington and Norfolk Charts).	Beginning at lat. 37°56′45″ N, long. 75°27′30″ W; SE to a point 3 nautical miles from the shoreline at lat. 37°51′20″ N, long. 75°16′45″ W; thence southerly 3 nautical miles from and parallel to the shoreline at an approximate lat. 37°35′00″ N, long. 75°32′30″ W; due W to long. 75°37′00″ W; to lat. 37°45′00″ N, long. 75°32′30″ W; due N to lat. 37°51′00″ N; to lat. 37°56′45″ N, long. 75°27′30″ W, point of beginning.	Unlimited	do	Naval Aviation Ordnance Test Station, Chincoteague, Va.
Dahlgren (Washington Chart).	(1) Beginning at lat. 38°07′00″ N, long. 76°24′30″ W; to lat. 37°53′10″ N, long. 76°14′00″ W; thence along the south shore of the Potomac River to lat. 37°59′20″ N, long. 76°26′30″ W; to lat. 38°05′00″ N, long. 76°33′30″ W; to lat. 38°08′00″ N, long. 76°33′40″ W; to lat. 38°07′00″ N, long. 76°28′30″ W; to lat. 38°07′00″ N, long. 76°24′30″ W, point of beginning.	Surface to 5,000 feet beneath portion on Red Civil Airway No. 77. Other portion unlimited.	do	Naval Proving Grounds, Dahlgren, Va.
	(2) Beginning at lat. 38°28′20″ N, long. 76°57′00″ W; to lat. 38°18′00″ N, long. 76°54′00″ W; to the western boundary of Blue Civil Airway No. 56 (Norfolk to Washington) at approximate lat. 38°14′30″ N, long. 76°42′40″ W; thence southerly along western boundary of said airway to its intersection with the northwestern boundary of Red Civil Airway No. 77 (Richmond to Millville) at approximate lat. 38°12′00″ N, long. 76°41′20″ W; SW along said airway to lat. 38°09′50″ N, long. 76°44′30″ W; to lat. 38°10′00″ N, long. 76°46′00″ W; thence along south shore of Potomac River to lat. 38°16′10″ N, long. 76°59′00″ W; to lat. 38°13′10″ N, long. 77°07′00″ W; to lat. 38°22′30″ N, long. 77°10′10″ W; to lat. 38°26′30″ N, long. 77°08′10″ W; to lat. 38°28′20″ N, long. 76°57′00″ W, point of beginning.	Unlimited	do	Do.
Pendleton (Norfolk Chart)	Beginning at lat. 36°46′48″ N, long. 75°57′24″ W; thence northeasterly along a line bearing 30° true to its intersection with a line paralleling the U.S. Coast line at a distance of 3 nautical miles at approximate lat. 36°51′100″ N, long. 75°54′30″ W; thence southerly along the line paralleling the coast line to its intersection with a line bearing 150° true from the point of origin, at approximate lat. 36°34′00″ N, long. 75°48′10″ W; thence northwesterly to lat. 36°46′48″ N, long. 75°57′24″ W, point of beginning.	do	do	CinC Lant Flt, Norfolk, Va.
Plum Tree Island (Norfolk Chart).	N boundary: lat. 37°10′00″ N, E boundary: long. 76°18′00″ W; S boundary: lat. 37°07′00″ N; W boundary: long. 76°23′00″ W.	Surface to 12,000 feet	Daylight hours only	Tactical Air Command and National Advisory Commission for Aeronautics, Langley AFB, Va.

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
	VIRGINIA—Continued			
Quantico (Washington Chart).	Beginning at lat. 38°33′00″ N, long. 77°20′00″ W; SW to lat. 38°29′00″ N, long. 77°28′45″ W; NW along State Highway No. 213 to lat. 38°31′30″ N, long. 77°33′20″ W; N to lat. 38°32′40″ N, long. 77°33′20″ W; NE to lat. 38°38′20″ N, long. 77°30′00″ W; E to long. 77°26′30″ W; SE along the Quantico-Manassas Highway to lat. 38°33′00″ N, long. 77°20′00″ W, point of beginning.	Surface to 10,000 feet	Daylight hours only Monday through Saturday.	Marine Corps Air Station, Quantico, Va.
Ship Shoal Island (Norfolk Chart).	A circular area with a 5 mile radius centered at lat. 37°14′00″ N, long. 75°47′30″ W.	Surface to 12,000 feet	Daylight hours only	Tactical Air Command, Langley AFB, Va.
	WASHINGTON			
Admiralty Inlet (Bellingham Chart).	Circular area with a radius of 3 miles centered at lat. 48°06′43″ N, long. 122°35′49″ W.	Surface to 20,000 feet	Continuous	Commander, Fleet Air, Seattle, Wash.
Fort Lewis (Seattle Chart).	Beginning at lat. 47°05′30″ N, long. 122°33′30″ W; SW to lat. 47°00′00″ N, long. 122°36′20″ W; westerly along river to lat. 46°59′50″ N, long. 122°37′50″ W; NW along river to lat. 47°03′30″ N, long. 122°41′45″ W; N along railroad to lat. 47°04′15″ N, long. 122°34′40″ W; SE to lat. 47°05′30″ N, long. 122°33′30″ W, point of beginning.	Surface to 14,000 feet	do	Sixth Army, San Francisco, Calif
Moses Lake (Spokane Chart).	Beginning at lat. 47°04′50″ N, long. 119°22′00″ W; W to lat. 47°04′50″ N, long. 119°51′20″ W; SW to lat. 47°02′20″ N, long. 119°55′00″ W; S to lat. 46°49′40″ N, long. 119°55′00″ W; E to lat. 46°49′40″ N, long. 119°22′00″ W; N to lat. 47°04′50″ N, long. 119°22′00″ W, point of beginning.	Unlimited	Daylight hours only	Ogden Air Materiel Area, Hill Field, Ogden, Utah
Rosario Strait (Bellingham Chart).	Circular area with a radius of 3 miles centered at lat. 48°29′06″ N, long. 122°45′22″ W.	Surface to 20,000 feet	Continuous	Commander Fleet Air, Seattle, Wash.
Saratoga Passage (Bellingham Chart).	Beginning at lat. 48°13′00″ N, long. 122°32′10″ W; SE along the western shoreline of Camano Island to lat. 48°07′40″ N, long. 122°28′00″ W; SSE to lat. 48°06′00″ N, long. 122°27′40″ W; W to long. 122°34′00″ W; NNW along the eastern shoreline of Whidbey Island to lat. 48°13′00″ N, long. 122°37′00″ W; E to lat. 48°13′00″ N, long. 122°32′10″ W, point of beginning.	do	do	Naval Air Station, Whidbey Island, Wash.
Waldron Island (Bellingham Chart).	Circular area with a radius of 3 miles centered at lat. 48°40′06″ N, long. 123°04′12″ W	do	do	Commander Fleet Air, Seattle, Wash.
Whidbey Island (Bellingham Chart).	Beginning at lat. 48°25′00″ N, long. 123°05′00″ W; SW to lat. 48°23′00″ N, long. 123°06′00″ W; SE to lat. 48°16′30″ N, long. 123°03′00″ W; due E to the western shore of Whidbey Island; NE along the shoreline to lat. 48°25′00″ N, long. 122°39′00″ W; W to lat. 48°25′00″ N, long. 123°05′00″ W, point of beginning.	do	do	Do
Yakima (Seattle and Spokane Charts).	Beginning at lat. 45°51′00″ N, long. 119°58′00″ W; southerly along the Columbia River to lat. 46°38′00″ N, long. 119°55′30″ W; S to lat. 46°33′00″ N; W to long. 120°15′00″ W; N to lat. 46°35′00″ N; W to long. 120°20′00″ W; northerly to lat. 46°51′00″ N, long. 120°21′30″ W; E to long. 120°16′30″ W; NE to lat. 46°54′30″ N, long. 120°15′00″ W; clockwise along the arc of a circle with a radius of 12 miles centered at lat. 46°44′45″ N, long. 120°20′00″ W, to lat. 46°51′00″ N, long. 120°06′30″ W; E to lat. 45°51′00″ N, long. 119°58′00″ W, point of beginning.	Surface to 42,000 feet	0600 to 1800 daily	6th Army, San Francisco, Calif.
	WISCONSIN			
Camp McCoy (Dubuque and Twin Cities Charts).	Beginning at lat. 44°10′00″ N, long. 90°46′00″ W; E to long. 90°35′00″ W; S to lat. 43°54′00″ N; W to long. 90°46′00″ W; N to lat. 44°10′00″ N, long. 90°46′00″ W, point of beginning.	Surface to 20,000 feet	Continuous	Department of Army, Camp McCoy, Wis
Haven (Milwaukee Chart).	Beginning at lat. 43°52′30″ N, long. 87°44′00″ W; NE to lat. 44°00′30″ N, long. 87°36′00″ W; SE to lat. 43°56′00″ N, long. 87°30′00″ W; due S to lat. 43°48′00″ N; SW to lat. 43°44′00″ N, long. 87°33′00″ W; NW to lat. 43°51′00″ N; long. 87°44′00″ W; due N to lat. 43°52′30″ N, long. 87°44′00″ W, point of beginning.	Surface to 55,000 feet	0600 to 2000 daily, June 15 to Sept. 14, 1949.	Headquarters 5th Army, Chicago, Ill
Sheboygan-Port Washington (Milwaukee Chart).	Beginning at lat. 43°44′30″ N, long. 37°36′00″ W; SE to lat. 43°41′30″ N, long. 87°25′00″ W; SW to lat. 43°20′30″ N, long. 87°35′00″ W; NW to lat. 43°23′30″ N, long. 87°46′00″ W; NE to lat. 43°44′30″ N, long. 87°36′00″ W, point of beginning.	10,000 feet to 25,000 feet	Daylight hours only	10th Air Force, Fort Benjamin Harrison, Ind.
	WYOMING			
Casper (Casper Chart)	N boundary: lat. 43°15′00″ N; E boundary: long. 106°39′00″ W; S boundary: lat. 43°09′00″ N; W boundary: loug. 106°49′00″ W.	Surface to 15,000 feet	Daylight hours only	National Guard Units of the 10th and 15th Air Force, Casper, Wyo.
Split Rock (Casper Chart).	N boundary: lat. 42°47′00″ N; E boundary: long. 107°04′00″ W; S boundary: lat. 42°31′00″ N; W boundary: long. 107°54′00″ W.	Surface to 30,000 feet	do	Do
	ALASKA			
Adask Island (Aleutian Islands) (Adak Chart).	(1) Beginning at lat. 51°44′10″ N, long. 176°23′50″ W; S to lat. 51°39′00″ N; to lat. 51°31′00″ N, long. 176°56′00″ W; N to lat. 51°35′30″ N; to lat. 51°44′10″ N, long. 176°23′50″ W, point of beginning. (Center of area: lat. 51°37′00″ N, long. 176°40′00″ W).	Unlimited	Continuous	Hdq., 17th Naval District, Kodiak, Alaska.
	(2) Beginning at lat. 51°44′30″ N, long. 176°01′40″ W; S to lat. 50°54′30″ N; W to long. 176°17′40″ W; N to lat. 51°44′30″ N; E to lat. 51°44′30″ N, long. 176°01′40″ W, point of beginning. (Center of area: lat. 51°24′30″ N, long. 176°10′00″ W).	do	do	Do.
	(3) A circular area having a radius of 3 miles centered at lat. 51°58′45″ N, long. 175°32′40″ W.	do	do	Do.
	(4) A circular area having a radius of 3 miles centered at lat. 52°02′45″ N, long. 175°54′15″ W.	do	do	Do.
	(5) Beginning at lat. 52°01′30″ N, long. 176°15′30″ W; to lat. 51°58′30″ N, long. 176°10′00″ W; to lat. 51°52′45″ N, long. 176°17′30″ W; to lat. 51°55′30″ N, long. 176°23′15″ W; to lat. 52°01′30″ N, long. 176°15′30″ W, point of beginning. (Center of area: lat. 51°56′30″ N, long. 176°16′30″ W).	do	do	Do.
Attu Island (Aleutian Islands) (Near Islands Chart).	(1) Beginning at lat. 53°30′00″ N, long. 174°00′00″ W; S to lat. 53°10′00″ N; W to long. 173°35′00″ W; N to lat. 53°30′00″ N; E to lat. 53°30′00″ N, long. 174°00′00″ W, point of beginning. (Center of area: lat. 53°20′00″ N, long. 173°47′15″ W).	do	do	Do.
	(2) Beginning at lat. 52°40′00″ N, long. 173°10′00″ W; S to lat. 52°30′00″ N; W to long. 173°55′00″ W; N to lat. 52°40′00″ N; E to lat. 52°40′00″ N, long. 173°10′00″ W, point of beginning. (Center of area lat. 52°34′15″ N, long. 173°02′00″ W).	do	do	Do.

ALASKA—Continued

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Chiniak Bay (Kodiak Island Chart).	Beginning at lat. 57°45′20″ N, long. 152°11′30″ W; SE to lat. 57°40′45″ N, long. 152°07′30″ W; NE to lat. 57°44′55″ N, long. 151°50′40″ W; NW to lat. 57°49′30″ N, long. 151°54′45″ W; SW to lat. 57°45′20″ N, long. 152°11′30″ W, point of beginning.	Surface to 3,000 feet	0800 to 1700 daily	Hdq., 17th Naval District, Kodiak, Alaska.
Cook Inlet (McKinley 118 Chart).	Beginning at a point 2 miles inland from the west shore of Cook Inlet and 1½ miles north of the light at the mouth of Beluga River approximate lat. 61°14′00″ N, long. 150°55′00″ W; thence southwesterly 2 miles inland and parallel to the shoreline to a point WNW of Harriet Point, approximate lat. 60°24′00″ N, long. 152°18′00″ W; WNW 16 miles to the highest point on Mount Redoubt, approximate lat. 60°29′00″ N, long. 152°44′00″ W; NNE 58 miles to the highest point on Mount Spur approximate lat. 61°18′00″ N; long. 152°17′00″ W; ENE to the foot of Triumvirate Glacier, approximate lat. 61°24′30″ N, long. 151°37′00″ W; SE to the mouth of the Beluga River approximate lat. 61°13′00″ N, long. 150°55′00″ W, point of beginning.	Between 3,500 and 25,000 feet.	Daylight hours only	Alaskan Air Command, Fort Richardson, Alaska.
Fairbanks (Yukon River 77 Chart).	Beginning at lat. 64°45′00″ N, long. 147°30′00″ W; SE along the south shore of the Tanana River to lat. 64°20′00″ N, long. 146°53′00″ W; W to the north shore of the Wood River at lat. 64°20′00″ N, long. 147°55′00″ W, NW along the north shore of the Wood River to lat. 64°34′00″ N, long. 148°23′00″ W; NE to lat. 64°45′00″ N, long. 147°30′00″ W, point of beginning.	Unlimited	Continuous	Do.
Kodiak Island (Aleutian Islands) (Kodiak Island Chart).	(1) Beginning at lat. 58°40′00″ N, long. 152°32′00″ W; to lat. 58°29′30″ N, long. 152°48′15″ W; to lat. 58°35′00″ N, long. 153°32′30″ W; to lat. 58°46′00″ N, long. 153°16′00″ W; to lat. 58°40′00″ N, long. 152°32′00″ W, point of beginning. (Center of area: lat. 58°37′00″ N, long. 153°02′00″ W.)	do	do	Hdq., 17th Naval District, Kodiak, Alaska.
	(2) North boundary: lat. 57°35′00″ N, E boundary: long. 150°53′00″ W, S boundary: lat. 57°00′00″ N, W boundary: long. 151°24′00″ W.	Surface to 10,000 feet	0800 to 1700 daily	Do.
Sea Lion Rock	(3) Circular area having a radius of 5 miles centered at lat. 58°21′00″ N, long. 151°48′00″ W.	Surface to 3,000 feet	do	Do.
Tanaga Island (Aleutian Islands) (Tanaga Island Chart).	Circular area having a radius of 3 miles centered at lat. 51°39′05″ N, long. 178°00′00″ W.	Unlimited	Continuous	Do.

HAWAII

Name and location (chart)	Description by geographical coordinates	Designated altitudes	Time of designation	Using agency
Ilio Point (Molokai, Oahu) (Oahu 599 Chart).	Beginning at lat. 21°15′00″ N, long. 157°06′30′ W; to lat. 21°13′40″ N, long. 157°05′08″ W; to lat. 21°07′25″ N, long. 157°11′28″ W; W to long. 157°18′10″ W; to lat. 21°08′15″ N, long. 157°19′46″ W; to lat. 21°15′00″ N, long. 157°16′48″ W; to lat. 21°15′00″ N, long. 157°06′30″ W, point of beginning.	Surface to 15,000 feet	Continuous	Jointly used by Department of Navy and Air Force. Comdr. Naval Air Bases, 14th Naval Dist., Pearl Harbor, T. H., and Pacific Air Command, Hickam Field, Honolulu, T. H.
Island of Kahoolawe (Island of Oahu 599 Chart).	Entire island area, centered at lat. 20°32′39″ N, long. 156°37′10″ W, including a 1 mile (nautical) bounday thereof.	Unlimited	do	Do.
Kaena Point (Oahu 599 Chart)	Beginning at lat. 21°35′00″ N, long. 158°16′00″ W; to lat. 21°38′00″ N, long. 158°32′00″ W, thence clockwise along the arc of a circle with a 16.5 mile radius centered on lat. 21°35′00″ N, long. 158°16′00″ W, point of beginning; to lat. 21°44′00″ N, long. 158°04′00″ W; to lat. 21°35′00″ N, long. 158°16′00″ W, point of beginning, excluding portion beyond 3 mile limit of shoreline.	Surface to 40,000 feet	0700 to 1700 and 1930 to 2000 daily.	U. S. Army, Pacific, Fort Shafter, Oahu, T. H.
Kahuku Point (Island of Oahu Chart).	Centered at lat. 21°43′00″ N, long. 157°56′30″ W, with a circular radius of 1.5 miles.	Surface to 15,000 feet	Continuous	Comdr. Naval Air Base, 14th Naval District, Pearl Harbor, T. H.
Kamalo (Molokai) (Island of Oahu Chart).	Centered at lat. 21°03′05″ N, long. 156°54′20″ W, with a circular radius of 1.5 miles.	do	0.700 to 1800	Do.
Mana (Kauai) Barking Sands Danger Area (Oahu Chart).	Beginning at lat. 22°04′15″ N, long. 159°45′10″ W; to lat. 22°06′30″ N, long. 159°50′00″ W; to lat. 22°10′30″ N, long. 159°47′30″ W; to lat. 22°05′30″ N, long. 159°44′10″ W; to lat. 22°04′15″ N, long. 159°45′10″ W, point of beginning, excluding that portion lying beyond the 3 mile limit of the shoreline.	Surface to 10,000 feet	Daylight hours only	Pacific Air Command, Hickam Field, Honolulu, T. H.
Mokuhooniki Rock (Molokai) (Oahu Chart).	Centered at lat. 21°08′10″ N, long. 156°42′20″ W, with a radius of 1.5 miles.	Unlimited	Continuous	Comdr. Naval Air Bases, 14th Naval District, Pearl Harbor, T. H.
Mokuleia (Oahu) (Oahu Chart).	Beginning at the firing point, lat 21°35′00″ N, long 158°13′00″ W, to lat. 21°38′00″ N, long. 158°18′00″ W; thence clockwise along the arc of a circle with a 6.8 mile radius centered on lat. 21°35′00″ N, long. 158°13′00″ W, point of origin, to lat. 21°39′00″ N, long. 158°08′00″ W; to lat. 21°35′00″ N, long. 158°13′00″ W, point of beginning, excluding portion beyond 3 mile limit of shoreline.	Surface to 30,000 feet	0700 to 1700 daily	U. S. Army, Pacific, Fort Shafter, Oahu, T. H.

[Supp. 7, 14 F. R. 1913, as amended by Amdt. 1, 14 F. R. 3181, Amdt. 2, 14 F. R. 3393]

§ 60.14 *Right-of-way.* An aircraft which is obliged by the following rules to keep out of the way of another shall avoid passing over or under the other, or crossing ahead of it, unless passing well clear;

NOTE: Right-of-way rules do not apply when, for reasons beyond the pilot's control, aircraft cannot be seen due to restrictions of visibility. The aircraft which has the right-of-way will normally maintain its course and speed, but nothing in this part relieves the pilot from the responsibility for taking such action as will best aid to avert collision.

(a) *Distress.* An aircraft in distress has the right-of-way over all other air traffic:

(b) *Converging.* Aircraft converging shall give way to other aircraft of a different category in the following order: airplanes and rotorcraft shall give way to airships, gliders, and balloons; airships shall give way to gliders and balloons; gliders shall give way to balloons. When two or more aircraft of the same category are converging at approximately the same altitude, each aircraft shall give way to the other which is on its right. In any event, mechanically driven aircraft shall give way to aircraft which are seen to be towing other aircraft;

NOTE: In effect, an aircraft will give way to another of a different class which is less maneuverable and is unable to take as effective action to avoid collision. For this reason aircraft towing others are given the right-of-way.

(c) *Approaching head-on.* When two aircraft are approaching head-on, or approximately so, each shall alter its course to the right;

(d) *Overtaking.* An aircraft that is being overtaken has the right-of-way, and the overtaking aircraft, whether climbing, descending, or in horizontal flight, shall keep out of the way of the other aircraft by altering its course to the right, and no subsequent change in the relative positions of the two aircraft shall absolve the overtaking aircraft from this obligation until it is entirely past and clear;

NOTE: Passing an overtaken aircraft on the right is required because the pilot in side-by-side, dual-control aircraft is seated on the left and has a better view on that side. Further, in narrow traffic lanes, passing on the left of an overtaken aircraft would place the overtaking aircraft in the path of the oncoming traffic.

(e) *Landing.* Aircraft, while on final approach to land, or while landing, have the right-of-way over other aircraft in flight or operating on the surface. When two or more aircraft are approaching an airport for the purpose of landing, the aircraft at the lower altitude has the right-of-way, but it shall not take advantage of this rule to cut in in front of another which is on final approach to land, or to overtake that aircraft.

NOTE: Pilots must recognize that once committed to a landing in certain aircraft the pilot has little chance to avoid other aircraft which may interfere with that landing and, therefore, careful observance of this rule is important to the safety of all concerned.

§ 60.15 *Proximity of aircraft.* No person shall operate an aircraft in such proximity to other aircraft as to create a collision hazard. No person shall operate an aircraft in formation flight when passengers are carried for hire. No aircraft shall be operated in formation flight except by prearrangement between the pilots in command of such aircraft.

§ 60.16 *Acrobatic flight.* No person shall engage in acrobatic flight:

(a) Over congested areas of cities, towns, settlements, or over an open-air assembly of persons, or

(b) Within any civil airway or control zone, or

(c) When the flight visibility is less than 3 miles, or

(d) Below an altitude of 1,500 feet above the surface.

NOTE: Acrobatic maneuvers performed over a congested area or an open assembly of persons, or in areas where considerable air traffic exists, creates an undue hazard to persons or property. Flight visibility of at least 3 miles is believed to be a prerequisite to acrobatic flight in order that the pilot, after scanning the entire vicinity, may be reasonably assured that no other aircraft is within dangerous proximity prior to performing such maneuvers.

§ 60.17 *Minimum safe altitudes.* Except when necessary for take-off or landing, no person shall operate an aircraft below the following altitudes:

(a) *Anywhere.* An altitude which will permit, in the event of the failure of a power unit, an emergency landing without undue hazard to persons or property on the surface;

(b) *Over congested areas.* Over the congested areas of cities, towns or settlements, or over an open-air assembly of persons, an altitude of 1,000 feet above the highest obstacle within a horizontal radius of 2,000 feet from the aircraft. Helicopters may be flown at less than the minimum prescribed herein if such operations are conducted without hazard to persons or property on the surface and in accordance with paragraph (a) of this section; however, the Administrator, in the interest of safety, may prescribe specific routes and altitudes for such operations, in which event helicopters shall conform thereto;

NOTE: The rule recognizes the special flight characteristics of the helicopter which can accomplish an emergency landing within a relatively small space. However, if a helicopter is flown over the congested area of a city, town or settlement, at less than 1,000 feet above the highest obstacle, the pilot is required to fly with due regard to places in which an emergency landing can be made with safety and, further, to maintain an altitude along the flight path thus selected from which such an emergency landing can be effected at any time.

(c) *Over other than congested areas.* An altitude of 500 feet above the surface, except over open water or sparsely populated areas. In such event, the aircraft shall not be operated closer than 500 feet to any person, vessel, vehicle, or structure. Helicopters may be flown at less than the minimums prescribed herein if such operations are conducted without hazard to persons or property on the surface and in accordance with paragraph (a) of this section.

NOTE: When flight is necessary at an altitude of less than 500 feet above the surface, the pilot must avoid creating any hazard to persons or property on the surface which may result from such flight. In no event should the pilot expose his passengers to unnecessary hazard while engaging in flight at low altitude. The maneuverability of the helicopter permits safe flight below the minimums required in § 60.17, provided good judgment and caution are exercised by the pilot.

(d) *IFR operations.* The minimum IFR altitude established by the Administrator for that portion of the route over which the operation is conducted. Such altitude shall be that which the safe conduct of flight permits or requires considering the character of the terrain being traversed, the meteorological services and navigational facilities available, and other flight conditions. Where the Administrator has not established such a minimum, operations shall be conducted at not less than 1,000 feet above the highest obstacle within a horizontal distance of 5 miles from the center of the course intended to be flown.

NOTE: When minimum altitudes are established by the Administrator for particular routes, such altitudes will be published in the CAA Flight Information Manual, for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

[Amdt. 60-0, 12 F. R. 5547, as amended by Amdt. 60-3, 13 F. R. 1224]

§ 60.17-1 *Instrument flight rule altitude minimums (CAA rules which apply to § 60.17).* See Part 610 of this title.

[12 F. R. 7801. Correction noted at 14 F. R. 38]

§ 60.18 *Operation on and in the vicinity of an airport.* Aircraft shall be operated on and in the vicinity of an airport in accordance with the following rules:

(a) When approaching for landing, all turns shall be made to the left unless the airport displays standard visual markings approved by the Administrator and which indicate that all turns are to be made to the right, or unless otherwise authorized by air traffic control;

NOTE: Where right-hand turns and clockwise flow of traffic are desirable in the interest of safety, airport markings visible from the air will inform the transient pilot of the necessity for making turns to the right.

(b) If air traffic control is in operation at the airport, contact shall be maintained with such control, either visually or by radio, to receive any air traffic control instructions which may be issued;

(c) Aircraft operating from an airport shall conform to the traffic patterns prescribed for that airport;

(d) The Administrator may, when necessary in the interest of safety, prescribe traffic patterns for an airport which shall supersede any other traffic patterns previously prescribed;

(e) When light signals are used for the control of air traffic, they shall be of the color and have the meaning prescribed by the Administrator.

NOTE: Light signals and their meanings are published in the CAA Flight Information Manual, for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

§ 60.18-1 *Right-turn indicators (CAA rules which apply to § 60.18).* The L shaped marker described hereinafter is approved as a standard visual marker which indicates that turns are to be made to the right. The marker shall be prepared in such size and color, and located in such area, that when displayed between sunrise and sunset it will be readily visible to pilots using the airport. The marker shall be placed in such a position that the short member of the L will show the direction of traffic in the air, the long member of the L will point out the landing strip to be used, and the entire L will indicate the course of the turn to be executed by pilots using the landing strip.

NOTE: The L shaped marker is applied to the Segmented Circle Airport Marker System in Technical Standard Order TSO-N5.

[13 F. R. 6079]

§ 60.18-2 *LaGuardia Airport, N. Y., traffic patterns (CAA rules which apply to § 60.18).* Aircraft taking off or landing at the LaGuardia, N. Y., Airport shall adhere to the following traffic patterns and altitudes made a part thereof, unless otherwise authorized by air traffic control.

(a) *Runway No. 13*—(1) *Takeoff.* Execute a climbing right turn over Yacht Basin, and proceed over Flushing Meadows to extreme south tip thereof or until reaching an altitude of at least 1200 feet before proceeding on course.

(2) *Landing.* Maintain an altitude of at least 1200 feet until over Hellgate Channel, 5 stacks or the East River and approach by descending over water insofar as practical.

(b) *Runway No. 31*—(1) *Takeoff.* Execute a climbing right turn to an altitude of at least 1200 feet over the East River insofar as practical before proceeding on course.

(2) *Landing.* Final approach from an altitude of at least 1200 feet over extreme southern tip of Flushing Meadow Park descending over the park and water insofar as practical.

(c) *Runway No. 9*—(1) *Takeoff.* Execute a climb north of Flushing Airport straight ahead to an altitude of at least 1200 feet before proceeding on course.

(2) *Landing.* Maintain an altitude of at least 1200 feet until on base leg making left turns only and approach by descending over water insofar as practical.

(d) *Runway No. 27*—(1) *Takeoff.* Execute a climbing right turn to an altitude of at least 1200 feet over East River insofar as practical, before proceeding on course.

(2) *Landing.* Maintain an altitude of at least 1,000 feet to the Cloverleaf at the south end of the Whitestone Bridge and descend north of the Flushing Airport, or make final approach from an altitude of at least 1200 feet over southern tip of Flushing Meadow Park.

(e) *Runway No. 4*—(1) *Takeoff.* Execute a climbing right turn to an altitude of at least 1200 feet over the East River before proceeding on course.

(2) *Landing.* Northbound flights make final approach from Maspeth marker descending from an altitude of at least 1200 feet.

Flights from other directions maintain an altitude of at least 1200 feet on base leg starting descent on final approach turn.

(f) *Runway No. 22*—(1) *Takeoff.* Climb straight ahead to an altitude of at least 1200 feet before proceeding on course.

(2) *Landing.* Maintain an altitude of at least 1200 feet until over Whitestone Bridge and approach by descending over water insofar as practical.

NOTE: The foregoing traffic patterns for LaGuardia Airport are illustrated in the map designated Figure 1.

[Supp. 9, 14 F. R. 479]

§ 60.18-3 *New York International (Idlewild) Airport; traffic patterns (CAA rules which apply to § 60.18).* Aircraft taking off or landing at the New York International (Idlewild) Airport shall adhere to the following traffic patterns and altitudes made a part thereof, unless otherwise authorized by air traffic control.

(a) *Runway No. 1-R*—(1) *Takeoff.* Execute slight left turn heading toward Baisley Pond climbing to an altitude of at least 1200 feet before proceeding on course.

(2) *Landing.* Start approach from an altitude of at least 1200 feet over Jamaica Bay, descending over water making left turn into runway.

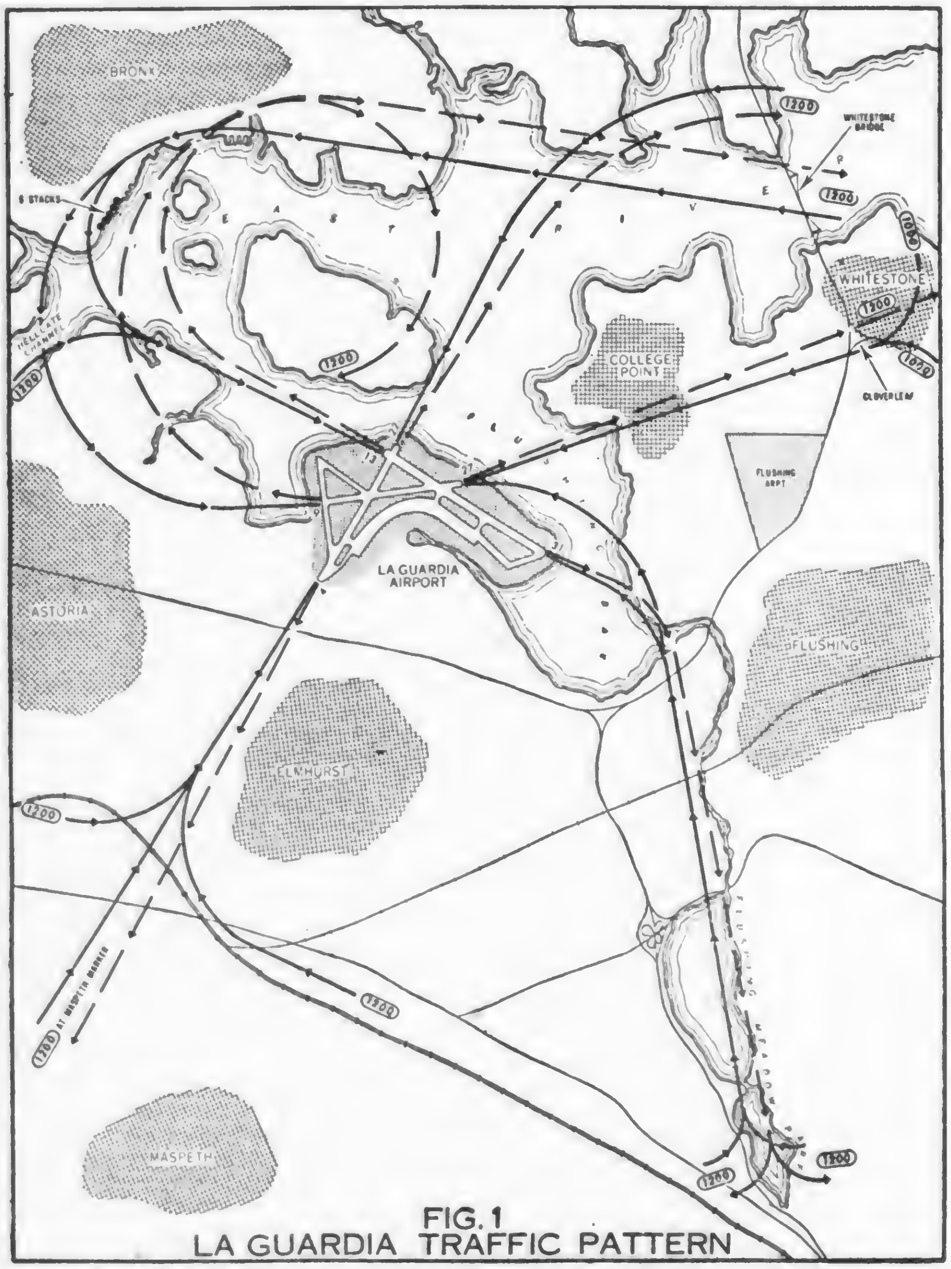

FIG. 1
LA GUARDIA TRAFFIC PATTERN

(b) *Runway No. 31-R*—(1) *Takeoff.* Execute a climbing left turn to an altitude of at least 1200 feet before proceeding on course.

(2) *Landing.* Start approach from old Valley Stream Airport from an altitude of at least 1200 feet descending over open area making right turn into runway, or start approach over Jamaica Bay from an altitude of at least 1200 feet descending over the water making a left turn into the runway.

(c) *Runway No. 25-L*—(1) *Takeoff.* Climb to an altitude of at least 1200 feet over Jamaica Bay before proceeding on course.

(2) *Landing.* Start approach from an altitude of at least 1200 feet over the south of the village of Valley Stream descending over open area to runway.

(d) *Runway No. 22-L*—(1) *Takeoff.* Climb to an altitude of at least 1200 feet over Jamaica Bay before proceeding on course.

(2) *Landing.* Start descent from an altitude of at least 1200 feet one mile north of Montefiore Cemetery.

(e) *Runway No. 19-L*—(1) *Takeoff.* Make climbing right turn to at least 1200 feet over Jamaica Bay before proceeding on course.

(2) *Landing.* Start approach from at least 1200 feet from one mile north of the north end of Baisley Pond descending along edge of airport.

(f) *Runway No. 13-L*—(1) *Takeoff.* Make climbing left turn over open area toward old Valley Stream Airport to at least 1200 feet before proceeding on course.

(2) *Landing.* Start approach from at least 1200 feet over Jamaica Bay descending in a right turn over water to the airport boundary.

(g) *Runway No. 7-R*—(1) *Takeoff.* Make slight right turn toward old Valley Stream Airport climbing to at least 1200 feet before proceeding on course.

(2) *Landing.* Descend from an altitude of at least 1200 feet over Jamaica Bay.

(h) *Runway No. 4-R*—(1) *Takeoff.* Climb straight ahead to at least 1200 feet before proceeding on course. This runway to be used only under conditions of extremely adverse winds.

(2) *Landing.* Descend from at least 1200 fet over Jamaica Bay.

NOTE: The foregoing traffic patterns for the New York International (Idlewild) Airport are illustrated in the map designated Figure 2.

[Supp. 9, 14 F. R. 479]

§ 60.18-4 *Newark, N. J., Airport; traffic patterns (CAA rules which apply to § 60.18).* Aircraft taking off or landing at the Newark, N. J., Airport shall adhere to the following traffic patterns and altitudes made a part thereof, unless otherwise authorized by air traffic control.

(a) *Runway No. 1*—(1) *Takeoff.* Execute a climbing right turn to an altitude of at least 1200 feet over the Kearney Meadows before proceeding on course.

(2) *Landing.* Start descent to the runway from an altitude of at least 1200 feet over the south end of Newark Bay.

(b) *Runway No. 28*—(1) *Takeoff.* Execute a climbing left turn of 45 degrees before reaching Lake Weequahic, then climb straight ahead to an altitude of at least 1200 feet before proceding on course.

(2) *Landing.* Maintain an altitude of at least 1200 feet on the base leg over Newark Bay until starting descent on the final approach turn.

(c) *Runway No. 24*—(1) *Takeoff.* Execute a climbing left turn of 90 degrees before reaching the range station, then climb to an altitude of at least 1200 feet over Newark Bay or the Arthur Kill River before proceeding on course.

(2) *Landing.* Maintain an altitude of at least 1200 feet until over the Pulaski Skyway at the Passaic River Crossing before starting descent for straight-in-approach.

(d) *Runway No. 19*—(1) *Takeoff.* Climb to an altitude of at least 1200 feet over Newark Bay or the Arthur Kill River before proceeding on course.

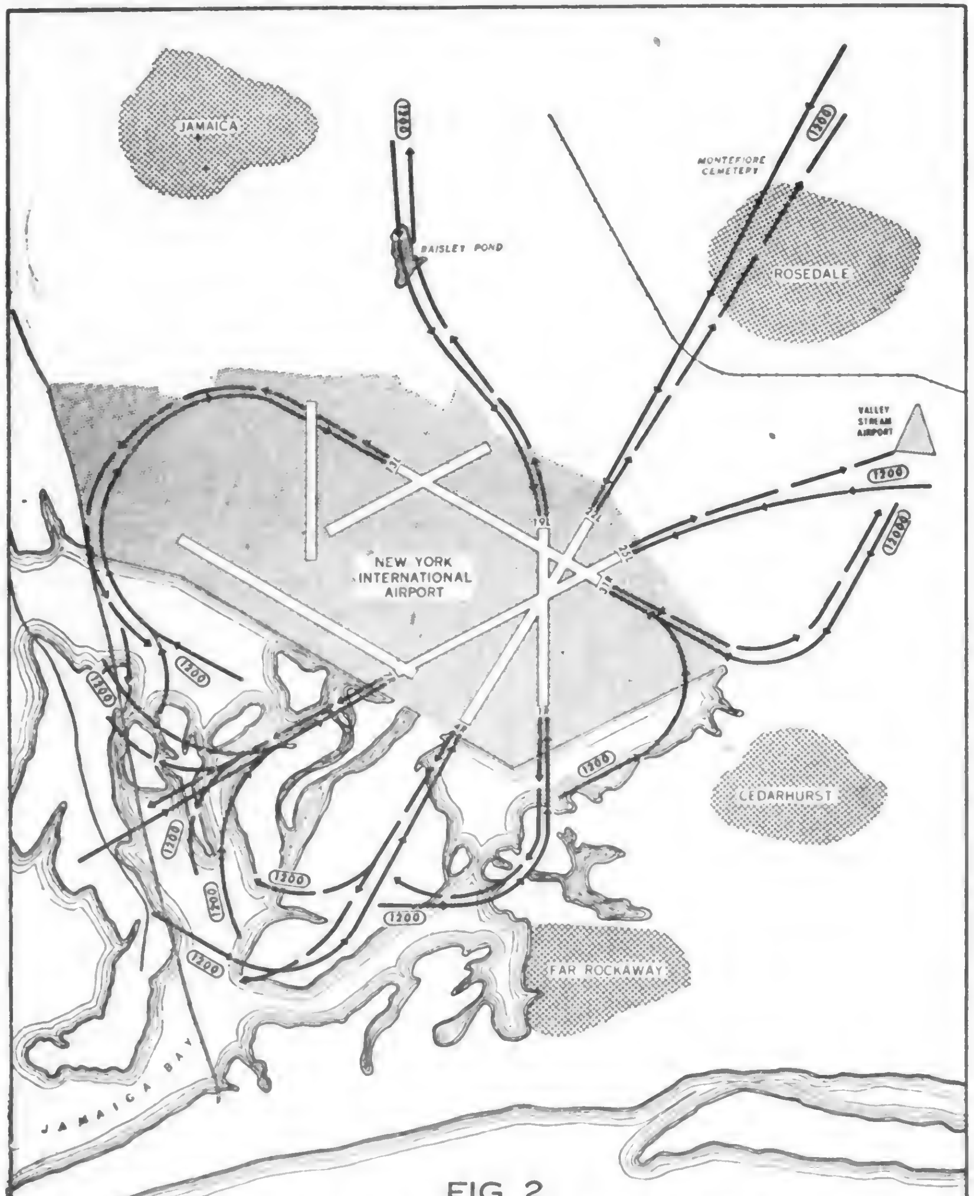

FIG. 2
NEW YORK INTERNATIONAL AIRPORT

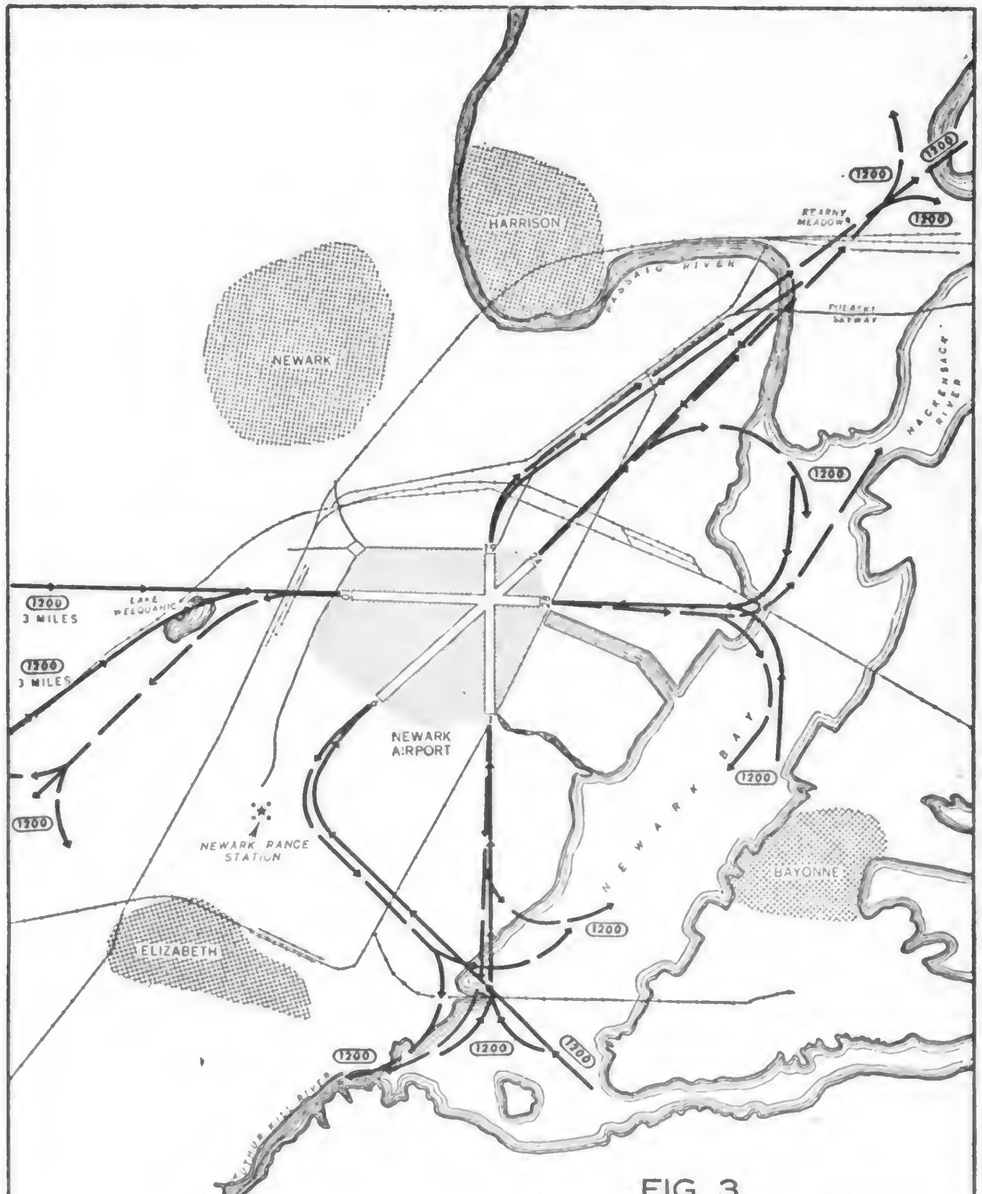

FIG. 3
NEWARK TRAFFIC PATTERN

(2) *Landing.* Maintain an altitude of at least 1200 feet until over the Pulaski Skyway at the Passaic River Crossing before starting descent to the runway.

(e) *Runway No. 10*—(1) *Takeoff.* Climb to an altitude of at least 1200 feet over Newark Bay or the Hackensack River before proceeding on course.

(2) *Landing.* Maintain an altitude of at least 1200 feet until within 3 miles of the airport before starting descent on final approach. Do not make left turn into runway.

(f) *Runway No. 6*—(1) *Takeoff.* Climb to an altitude of at least 1200 feet over Kearney Meadows or Newark Bay before proceeding on course.

(2) *Landing.* Start descent to runway from at least 1200 feet at south end of Newark Bay.

NOTE: The foregoing traffic patterns for the Newark Airport are illustrated in the map designated Figure 3.

[Supp. 9, 14 F. R. 479]

§ 60.19 *Air traffic control instructions.* No person shall operate an aircraft contrary to air traffic control instructions in areas where air traffic control is exercised.

§ 60.20 *Notification of arrival.* If a flight plan has been filed, the pilot in command of the aircraft, upon landing or completion of the flight, shall file an arrival or completion notice with the nearest Civil Aeronautics Administration communications station or control tower.

§ 60.21 *Adherence to air traffic clearances.* When an air traffic clearance has been obtained under either the VFR or IFR rules, the pilot in command of the aircraft shall not deviate from the provisions thereof unless an amended clearance is obtained. In case emergency authority is used to deviate from the provision of an air traffic clearance, the pilot in command shall notify air traffic control as soon as possible and, if necessary, obtain an amended clearance. However, nothing in this section shall prevent a pilot, operating on an IFR traffic clearance, from notifying air traffic control that he is canceling his IFR flight plan and proceeding under VFR: *Provided,* That he is operating in VFR weather conditions when he takes such action.

CROSS REFERENCE: For Special Civil Air Regulations SR-331 with respect to § 60.21, see note to Part 40 of this subchapter.

§ 60.22 *Water operations.* An aircraft operated on the water shall, insofar as possible, keep clear of all vessels and avoid impeding their navigation. The following rules shall be observed with respect to other aircraft or vessels operated on the water:

(a) *Crossing.* The aircraft or vessel which has the other on its right shall give way so as to keep well clear;

(b) *Approaching head-on.* When aircraft, or an aircraft and vessel, approach head-on, or approximately so, each shall alter its course to the right to keep well clear;

(c) *Overtaking.* The aircraft or vessel which is being overtaken has the right-of-way, and the one overtaking shall alter its course to keep well clear;

(d) *Special circumstances.* When two aircraft, or an aircraft and vessel, approach so as to involve risk of collision, each shall proceed with careful regard to existing circumstances and conditions including the limitations of the respective craft.

NOTE: The rules for operating aircraft on the surface of the water conform to marine rules for the operation of vessels. The "Special circumstances" rule is provided for situations wherein it may be impracticable or hazardous for a vessel or another aircraft to bear to the right because of depth of a waterway, wind conditions, or other circumstances.

§ 60.23 *Aircraft lights.* Between sunset and sunrise:

(a) All aircraft in flight or operated on the ground or under way on the water shall display position lights,

(b) All aircraft parked or moved within or in dangerous proximity to that portion of any airport used for, or available to, night flight operations shall be clearly illuminated or lighted, unless the aircraft are parked or moved in an area marked with obstruction lights,

(c) All aircraft at anchor shall display anchor lights, unless in an area within which lights are not required for vessels at anchor, and

(d) Within the Territory of Alaska the lights required in paragraphs (a), (b), and (c) of this section shall be displayed during those hours specified and published by the Administrator.

[Amdt. 60-2, 13 F. R. 475]

NOTE: International visual distress and urgency signals are contained in the CAA Flight Information Manual for sale by the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C.

§ 60.23-1 *Aircraft lights in Alaska (CAA rules which apply to § 60.23).* In Alaska the lights required by this section shall be displayed when any unlighted aircraft or other unlighted prominent objects cannot readily be seen beyond a distance of three miles, or when the sun is more than six degrees below the horizon.[1]

[13 F. R. 3227. Correction noted at 14 F. R. 38]

VISUAL FLIGHT RULES (VFR)

§ 60.30 *Ceiling and distance from clouds.* Aircraft shall comply with the following requirements as to ceiling and distance from clouds:

(a) *Within control zones.* Unless authorized by air traffic control, aircraft shall not be flown when the ceiling is less than 1,000 feet, or less than 500 feet vertically and 2,000 feet horizontally from any cloud formation.

(b) *Elsewhere.* When at an altitude of more than 700 feet above the surface aircraft shall not be flown less than 500 feet vertically and 2,000 feet horizontally from any cloud formation; when at an altitude of 700 feet or less aircraft shall not be flown unless clear of clouds.

[Amdt. 60-1, 13 F. R. 475]

§ 60.31 *Visibility*—(a) *Ground visibility within control zones.* When the ground visibility is less than 3 miles, no person shall take off or land an aircraft at an airport within a control zone, or enter the traffic pattern of such an airport, unless an air traffic clearance is obtained from air traffic control;

(b) *Flight visibility within control zones.* When the flight visibility is less than 3 miles, no person shall operate an aircraft in flight within a control zone, unless an air traffic clearance is obtained from air traffic control;

(c) *Flight visibility within control areas.* When the flight visibility is less than 3 miles, no person shall operate an aircraft within a control area;

NOTE: When the flight visibility is less than 3 miles, operations within control areas are to be conducted in accordance with instrument flight rules. Flight below 700 feet above the surface is not within a control area. See definition of control area, § 60.73.

(d) *Flight visibility elsewhere.* When outside of control zones and control areas, no person shall operate an aircraft in flight when the flight visibility is less than one mile. However, helicopters may be flown at or below 700 feet above the surface when the flight visibility is less than one mile if operated at a reduced speed which will give the pilot of such helicopter adequate opportunity to see other air traffic or any obstruction in time to avoid hazard of collision.

NOTE: When traffic conditions permit, air traffic control will issue an air traffic clearance for flights within, entering, or departing control zones when ground visibility or the flight visibility is less than 3 miles. The operator of any airport within a control zone, other than the airport upon which the control zone is centered, may secure continuing permission from air traffic control to conduct operations when the visibility is less than 3 miles: *Provided,* That such operations, at all times, remain 2,000 feet horizontally and 500 feet vertically from clouds, and traffic patterns are established and observed which avoid conflict with other operations. When outside of control zones and at an altitude of less than 700 feet above the surface, helicopters are permitted to fly when the flight visibility is less than one mile because of their special flight characteristics which allow them to proceed at low speed with safety.

§ 60.32 *Cruising altitudes.* When an aircraft is operated in level cruising flight at 3,000 feet or more above the surface, the following cruising altitudes shall be observed:

(a) *Within control zones and control areas.* At an odd or even thousand-foot altitude appropriate to the direction of flight as specified by the Administrator;

(b) *Elsewhere.* When the flight visibility is less than 3 miles, at an altitude appropriate to the magnetic course being flown as follows:

(1) 0° to 89° inclusive, at odd thousands (3,000; 5,000; etc.)

(2) 90° to 179° inclusive, at odd thousands plus 500 (3,500; 5,500; etc.).

(3) 180° to 269° inclusive, at even thousands (4,000; 6,000; etc.).

[1] "The duration of civil twilight is the interval in the evening from sunset until the time when the center of the sun is 6° below the horizon; or the corresponding interval in the morning between sunrise and the time at which the sun was still 6° below the horizon." "Tables of Sunrise, Sunset, and Twilight," United States Naval Observatory, 1946, p. 9.

(4) 270° to 359° inclusive, at even thousands plus 500 (4,500; 6,500; etc.).

NOTE: "Odd and even" thousand-foot altitudes specified by the Administrator for civil airways will be published in the CAA Flight Information Manual, for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. In view of increasing air traffic and the broad range of speed of aircraft, safety requires observance of the above cruising altitudes.

§ 60.33 *VFR flight plan.* If a VFR flight plan is filed, it shall contain such of the information listed in § 60.41 as air traffic control may require.

NOTE: Although flight plans are not required for VFR flight, air traffic control will accept such flight plans when desired by the pilot. Flights proceeding over sparsely populated areas or mountainous terrain may thus take advantage of any search and rescue facilities which may be available in emergencies. The information contained in such a flight plan is of importance to search and rescue operations.

INSTRUMENT FLIGHT RULES (IFR)

§ 60.40 *Application.* When aircraft are not flown in accordance with the distance-from-cloud and visibility rules prescribed in the visual flight rules, §§ 60.30–60.33, aircraft shall be flown in accordance with the rules prescribed in §§ 60.41–60.49.

§ 60.41 *IFR flight plan.* Prior to take-off from a point within a control zone or prior to entering a control area or control zone, a flight plan shall be filed with air traffic control. Such flight plan shall contain the following information unless otherwise authorized by air traffic control:

(a) Aircraft identification, and if necessary, radio call sign;

(b) Type of aircraft; or, in the case of a formation flight, the types and number of aircraft involved;

(c) Full name, address, and number of pilot certificate of pilot in command of the aircraft, or of the flight commander if a formation flight is involved;

(d) Point of departure;

(e) Cruising altitude, or altitudes, and the route to be followed;

(f) Point of first intended landing;

(g) Proposed true air speed at cruising altitude in miles per hour;

(h) Radio transmitting and receiving frequencies to be used;

(i) Proposed time of departure;

(j) Estimated elapsed time until arrival over the point of first intended landing;

(k) Alternate airport or airports, in accordance with the requirements of § 60.42;

(l) Amount of fuel on board expressed in hours;

(m) Any other information which the pilot in command of the aircraft, or air traffic control, deems necessary for air traffic control purposes.

(n) For international flights: The number of persons on board.

[Amdt. 60–0, 12 F. R. 5547, as amended by Amdt. 60–4, 14 F. R. 1486]

§ 60.42 *Alternate airport.* An airport shall not be listed in the flight plan as an alternate airport unless current weather reports and forecasts show a trend indicating that the ceiling and visibility at such airport will be at or above the following minimums at the time of arrival:

(a) *Airport served by radio directional facility.* Ceiling 1,000 feet, visibility one mile; or, ceiling 900 feet, visibility 1½ miles; or, ceiling 800 feet, visibility 2 miles;

(b) *Airport not served by radio directional facility.* Ceiling 1,000 feet with broken clouds or better, visibility 2 miles;

(c) *Minimums at individual airports.* The Administrator may, in the interest of safety, prescribe higher ceiling and visibility minimums at individual airports than required by paragraph (a) or (b) of this section; and for individual operations at particular airports, may specify lower minimums if he shall find that such reduced minimums will not decrease safety.

NOTE: The minimums set forth in § 60.42 are required for clearance prior to take-off and are not intended to limit use of any alternate airport if weather conditions change while en route, in which event the landing minimums published in the CAA Flight Information Manual shall apply. Minimums for particular airports which may be prescribed by the Administrator will be published in the CAA Flight Information Manual, for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

§ 60.43 *Air traffic clearance.* Prior to take-off from a point within a control zone, or prior to entering a control area or control zone, an air traffic clearance shall be obtained from air traffic control.

CROSS REFERENCE: For Special Civil Air Regulations SR-331 with respect to § 60.43, see note to Part 40 of this subchapter.

§ 60.44 *Cruising altitudes.* Aircraft shall be flown at the following cruising altitudes:

(a) *Within control areas and control zones.* At altitudes authorized by air traffic control;

(b) *Elsewhere.* At an altitude appropriate to the magnetic course being flown as follows:

(1) 0° to 89° inclusive, at odd thousands (1,000; 3,000; etc.).

(2) 90° to 179° inclusive, at odd thousands plus 500 (1,500; 3,500; etc.).

(3) 180° to 269° inclusive, at even thousands (2,000; 4,000; etc.).

(4) 270° to 359° inclusive, at even thousands plus 500 (2,500; 4,500; etc.).

NOTE: The above cruising altitudes are not in conflict with those required for flight under VFR rules.

§ 60.45 *Right-side traffic.* Aircraft operating along a civil airway shall be flown to the right of the center line of such airway, unless otherwise authorized by air traffic control.

CROSS REFERENCE: For Special Civil Air Regulations SR-331 with respect to § 60.45, see note to Part 40, of this subchapter.

§ 60.46 *Instrument approach procedure.* When instrument let-down to an airport is necessary, a standard instrument approach procedure prescribed for that airport by the Administrator shall be used, unless:

(a) A different instrument approach procedure specifically authorized by the Administrator is used, or

(b) A different instrument approach procedure is authorized by air traffic control for the particular approach, provided such authorization is issued in accordance with procedures approved by the Administrator.

NOTE: Standard instrument approach procedures prescribed by the Administrator are published in the CAA Flight Information Manual, for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Such procedures have been carefully investigated with respect to pattern and terrain clearance. Safety would not permit several aircraft to make simultaneous use of more than one instrument approach procedure unless such operations were controlled.

§ 60.46–1 *Standard instrument approach procedures (CAA rules which apply to § 60.46).* See Part 609 of this title.

[12 F. R. 8111. Correction noted at 14 F. R. 38]

§ 60.47 *Radio communications.* Within control zones and control areas the pilot in command of the aircraft shall ensure that a continuous watch is maintained on the appropriate radio frequencies and shall report by radio as soon as possible the time and altitude of passing each designated reporting point, or the reporting points specified by air traffic control, together with weather conditions which have not been forecast, and other information pertinent to the safety of flight.

NOTE: Designated reporting points are noted in publications of aids to air navigation. Control of air traffic is predicated on knowledge of the position of aircraft in flight. The reporting of unanticipated weather encountered en route such as icing or extreme turbulence may be of importance to the safety of other aircraft anticipating flight within the area.

CROSS REFERENCE: For Special Civil Air Regulations SR-331 with respect to § 60.47, see note to Part 40, of this subchapter.

§ 60.49 *Radio failure.* If unable to maintain two-way radio communications, the pilot in command of the aircraft shall:

(a) If operating under VFR conditions, proceed under VFR and land as soon as practicable, or

(b) Proceed according to the latest air traffic clearance to the radio facility serving the airport of intended landing, maintaining the minimum safe altitude or the last acknowledged assigned altitude whichever is higher. Descent shall start at the expected approach time last authorized or, if not received and acknowledged, at the estimated time of arrival indicated by the elapsed time specified in the flight plan.

NOTE: Detailed procedures to be followed by the pilot are contained in the CAA Flight Information Manual, for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

[Amdt. 60–0, 12 F. R. 5547, as amended by Amdt. 60–4, 14 F. R. 1487]

DEFINITIONS

§ 60.60 *Acrobatic flight.* Maneuvers intentionally performed by an aircraft involving an abrupt change in its attitude, an abnormal attitude, or an abnormal acceleration.

Note: The term "acrobatic flight" is not intended to include turns or maneuvers necessary to normal flight.

§ 60.61 *Aircraft.* Any contrivance used or designed for navigation of or flight in the air, except a parachute or other contrivance designed for such navigation but used primarily as safety equipment.

§ 60.62 *Airplane.* A mechanically propelled aircraft the support of which in flight is derived dynamically from the reaction on surfaces in a fixed position relative to the aircraft but in motion relative to the air.

§ 60.63 *Airport.* A defined area on land or water, including any buildings and installations, normally used for the take-off and landing of aircraft.

§ 60.64 *Airship.* A mechanically propelled aircraft whose support is derived from lighter-than-air gas.

§ 60.65 *Airspace restricted areas.* Designated areas in which flight is restricted, which are established by appropriate authority, and are shown on aeronautical charts and published in notices to airmen and aids to air navigation.

(a) *Airspace reservation.* An area established by Executive order of the President of the United States or by any State of the United States.

(b) *Danger area.* An area designated by the Administrator within which an invisible hazard to aircraft in flight exists.

§ 60.66 *Air traffic.* Aircraft in operation anywhere in the airspace and on that area of an airport normally used for the movement of aircraft.

§ 60.67 *Air traffic clearance.* Authorization by air traffic control, for the purpose of preventing collision between known aircraft, for an aircraft to proceed under specified traffic conditions within a control zone or control area.

§ 60.68 *Air traffic control.* A service operated by appropriate authority to promote the safe, orderly, and expeditious flow of air traffic.

§ 60.69 *Alternate airport.* An airport specified in the flight plan to which a flight may proceed when a landing at the point of first intended landing becomes inadvisable.

§ 60.70 *Expected approach time.* The time at which it is expected that an arriving aircraft will be cleared to commence approach for a landing.

[Amdt. 60-4, 14 F. R. 1487]

§ 60.71 *Balloon.* An aircraft, excluding moored balloons, without mechanical means of propulsion, the support of which is derived from lighter-than-air gas.

§ 60.72 *Ceiling.* The distance from the surface of the ground or water to the lowest cloud layer reported as "broken clouds" or "overcast".

§ 60.73 *Control area.* An airspace of defined dimensions, designated by the Administrator, extending upwards from an altitude of 700 feet above the surface, within which air traffic control is exercised.

§ 60.74 *Control zone.* An airspace of defined dimensions, designated by the Administrator, extending upwards from the surface, to include one or more airports, and within which rules additional to those governing flight in control areas apply for the protection of air traffic.

§ 60.75 *Cruising altitude.* A constant altimeter indication, in relation to sea level, maintained during a flight or portion thereof.

§ 60.76 *Flight plan.* Specified information filed either verbally or in writing with air traffic control relative to the intended flight of an aircraft.

§ 60.77 *Flight visibility.* The average horizontal distance that prominent objects may be seen from the cockpit.

§ 60.78 *Glider.* An aircraft without mechanical means of propulsion, the support of which in flight is derived dynamically from the reaction on surfaces in motion relative to the air.

§ 60.79 *Ground visibility.* The average range of vision in the vicinity of an airport as reported by the U. S. Weather Bureau or, if unavailable, by an accredited observer.

§ 60.80 *Helicopter.* A type of rotorcraft the support of which in the air is normally derived from airfoils mechanically rotated about an approximately vertical axis.

§ 60.81 *Sunset and sunrise.* Sunset and sunrise are the mean solar times of sunset and sunrise as published in the Nautical Almanac converted to local standard time for the locality concerned, except within the Territory of Alaska.

Note: The Nautical Almanac containing sunshine tables may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Information is also available from the sunshine tables in the offices of the Civil Aeronautics Administration or the United States Weather Bureau.

[Amdt. 60-2, 13 F. R. 475]

§ 60.82 *IFR.* The symbol used to designate instrument flight rules.

§ 60.83 *IFR conditions.* Weather conditions below the minimum prescribed for flights under VFR.

§ 60.84 *Magnetic course.* The true course or track, corrected for magnetic variation, between two points on the surface of the earth.

§ 60.85 *Reporting point.* A geographical location in relation to which the position of an aircraft is reported.

§ 60.86 *Rotorcraft.* An aircraft whose support in the air is chiefly derived from the vertical component of the force produced by rotating airfoils.

§ 60.87 *Traffic pattern.* The flow of aircraft operating on and in the vicinity of an airport during specified wind conditions as established by appropriate authority.

§ 60.88 *VFR.* The symbol used to designate visual flight rules.

§ 60.89 *VFR conditions.* Weather conditions equal to or above the minimum prescribed for flights under VFR.

Part 61—Scheduled Air Carrier Rules

AUTHORITY: §§ 61.1 to 61.346 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 245 (a). Interpret or apply secs. 601, 604, 605, 52 Stat. 1007, 1010; 49 U. S. C. 551, 554, 555.

SOURCE: §§ 61.1 to 61.346 contained in Civil Air Regulations, May 31, 1938, as amended by Reg. 601-A-1, 3 F. R. 2052, and Amendment 75, 5 F. R. 3946. Exceptions are noted following sections affected.

CROSS REFERENCES: For special regulation permitting flights of scheduled air carriers at certain altitudes to be conducted without compliance with certain sections of this part, see Note 1 preceding the text of Part 40. For special regulation authorizing the issuance of air carrier operating certificates permitting operations which do not fully meet the certification and operation requirements of this part, see Note 2 to Part 40.

GENERAL

§ 61.1 *Provision for issuance.* Pursuant to the provisions of the Civil Aeronautics Act of 1938, as amended, empowering the Administrator of Civil Aeronautics to issue air carrier operating certificates and the Board to establish minimum safety standards for the operation of air carriers to whom such certificates are issued, and for prohibiting the operation or navigation of aircraft of such air carriers in violation thereof, the following rules and regulations for the operation of scheduled air carriers engaged in interstate air transportation within the continental limits of the United States, in addition to those prescribed elsewhere in this subchapter, are hereby prescribed.

[CAR, May 31, 1938, as amended by Amdt. 134, 6 F. R. 5039]

§ 61.2 *Certificate required.* No air carrier shall operate aircraft in scheduled interstate air transportation within the continental limits of the United States carrying mail, goods or persons, or any combination thereof unless such air carrier is possessed of a valid air carrier operating certificate issued by the Administrator of Civil Aeronautics.

[Amdts. 61-21 through 61-31, 7 F. R. 1414]

§ 61.3 *Definitions.* (a) As used in this part the words listed below shall be defined as follows:

(1) *Category.* Category shall indicate a classification of aircraft such as airplane, helicopter, glider, etc.

(2) *Check pilot.* Check pilot is a pilot authorized by the Administrator to examine pilots of an air carrier to determine the pilot's proficiency with regard to procedure and piloting technique, route and equipment competency, and ability to pilot and navigate by instruments.

(3) *Class.* Class shall indicate a difference in basic design of aircraft within

a category, such as single-engine land, multi-engine sea, etc.

(4) *Copilot.* Copilot shall mean a pilot serving in any piloting capacity other than as pilot in command on aircraft requiring two pilots for normal operations, but excluding a pilot who is on board the aircraft for the sole purpose of receiving dual instruction.

(5) *Crew member.* Crew member means any individual assigned by an air carrier for the performance of duty on the aircraft other than as flight crew member during flight time.

(6) *Flight crew member.* Flight crew member means a pilot, flight radio operator, flight engineer, or flight navigator assigned to duty on the aircraft during flight time.

(7) *Flight time.* Flight time shall mean the total time from the moment the aircraft first moves under its own power for the purpose of flight until the moment it comes to rest at the end of the flight (block to block).

(8) *Instrument flight time.* Instrument flight time means that flight time during which a pilot is piloting an aircraft solely by reference to instruments and without external reference points, whether under actual or simulated instrument flight conditions.

(9) *Pilot.* A pilot is an individual who manipulates the controls of an aircraft during the time defined as flight time.

(10) *Pilot in command.* Pilot in command shall mean the pilot responsible for the operation and safety of the aircraft during the time defined as flight time.

(11) *Type.* Type shall mean all aircraft of the same basic design including all modifications thereto except those modifications which result in a change in handling or flight characteristics.

[Amdt. 61–4, 14 F. R. 2199]

SERVICE

§ 61.11 *Service performed.* No scheduled air carrier shall perform or render any service, as related to the carriage of mail, goods, or persons, or to day or night operation, until rated competent to render such service in the air carrier operating certificate issued by the Administrator.

[Amdts. 61–21 through 61–31, 7 F. R. 1414]

§ 61.12 *Operations schedules.* Operations schedules shall be set up with due regard to sufficient time for the adequate servicing with fuel and oil at intermediate stops and to prevailing winds, and on the basis of a cruising speed of the aircraft at not to exceed the specified cruising power output of the engines as operated in the aircraft. All air carrier aircraft when being tested for ratings will be checked to determine cruising speeds that are to be approved. Block-to-block time shall be used in establishing time from stop to stop.

ROUTE

§ 61.21 *Route operation.* No air carrier shall operate aircraft in scheduled air transportation over any route or part thereof until rated competent to operate thereover in its air carrier operating certificate except as provided by § 61.22.

[Amdt. 61–8, 8 F. R. 6809]

§ 61.22 *Off-route operation.* An air carrier may operate aircraft in scheduled air transportation from any alternate airport where such procedure is not specifically forbidden by the Administrator via a route not included in its air carrier operating certificate to a scheduled stop on its regular route, and in making such flight need not comply with those requirements of this subchapter pertaining to (1) pilot route competency, (2) adherence to lighted airways, and (3) the provisions relating to radio range courses if the flight can be conducted under contact flight rules. No such flight shall be made, except along a civil airway, unless the aircraft is equipped with a fully functioning automatic radio direction finder. When a flight is made over an unauthorized route the air carrier shall make a written report to the Administrator within seven days after the completion of such flight setting forth full details with respect to such flight.

[Amdt. 61–8, 8 F. R. 6809]

§ 61.23 *Regular route.* The conduct of operations by a scheduled air carrier shall at all times be in strict accordance with the terms of its air carrier operating certificate.

[CAR, May 31, 1938, as amended by Amdts. 61–21 through 61–31, 7 F. R. 1415]

§ 61.24 *Regular stops.* Regular terminals and intermediate stops shall be used only as specified in the air carrier operating certificate.

[CAR, May 31, 1938, as amended by Amdts. 61–21 through 61–31, 7 F. R. 1415]

§ 61.25 *Alternate airports.* Regular terminals, intermediate stops, or other adequate airports, may be used as alternates when used for the purpose of complying with clearance requirements: *Provided,* Such alternates are listed as such in the air carrier operating certificate.

[CAR, May 31, 1938, as amended by Amdts. 61–21 through 61–31, 7 F. R. 1415]

AIRCRAFT

§ 61.31 *Aircraft operation.* (a) No scheduled air carrier shall operate any aircraft until rated competent with respect thereto in the air carrier operating certificate issued by the Administrator.

[Amdt. 61–21 through 61–31, 7 F. R. 1415]

(b) Irrespective of the basis for certification, all aircraft in passenger service possessing engine(s) rated at more than 600 h. p. (each) for maximum continuous operation shall comply with the following, except that, if the Administrator finds that in particular models of existing aircraft literal compliance with specific items of these requirements might be extremely difficult of accomplishment and that such compliance would not contribute materially to the objective sought, he may accept such measures of compliance as he finds will effectively accomplish the basic objectives of this part:

(1) Sections 4b.58 and 4b.447 (a) of this chapter.

(2) At the first major fuselage overhaul subsequent to May 1, 1947, but in any case not later than November 1, 1948, §§ 4b.442, 4b.445, 4b.447, (b), (c) and (d), 4b.448 (b) and 4b.448 (c) of this subchapter.

(3) At the first major wing center-section overhaul subsequent to May 1, 1947, but in any case not later than November 1, 1948, §§ 4b.478, 4b.484, 4b.503, (c), 4b.516–4b.518, 4b.556, 4b.557, 4b.560, 4b.561, 4b.586 and 4b. 621–4b.624, 4b.651–4b.655, 4b.661 (a) and (c), and 4b.662–4b.676 of this chapter.

[CAR, May 31, 1938, as amended by Amdts. 61–21 through 61–31, 7 F. R. 1415. Amdt. 61–2, 11 F. R. 11355, Amdt. 61–16, 13 F. R. 1899]

CROSS REFERENCE: For Special Civil Air Regulation SR–329, with respect to extension of date for compliance with fire prevention requirements, see note following § 41.20 of this subchapter.

§ 61.32 *Multiengine fuel system arrangement.* On and after October 31, 1946, the fuel systems of scheduled air carrier multiengine aircraft shall be arranged to permit operation in such manner that the failure of any one component will not result in the irrecoverable loss of power of more than one engine. A separate fuel tank need not be provided if the Administrator finds that the fuel system incorporates features which provide equivalent safety.

[Amdt. 61–6, 11 F. R. 3244]

SINGLE-ENGINE AIRCRAFT

§ 61.41 *Day operation over land.* No single-engine seaplane shall be operated over land with passengers unless such aircraft can, at all times, reach open water suitable for a landing in the event of complete power failure.

§ 61.42 *Night operation over land.* No single-engine aircraft shall be operated at night with passengers.

§ 61.43 *Day operation over water.* The following rules shall govern the operation of single-engine aircraft in day operation over water:

(a) No single-engine land aircraft shall be operated over water unless such aircraft can at all times reach land suitable for a landing in the event of a complete power failure.

(b) No single-engine water aircraft may be operated over water unless a landing may be effected at all times within a distance of 8 miles from shore, in the event of a complete power failure.

(c) No single-engine water aircraft shall be operated over water, except during such time and seasons as permit the use of such water for landing without any hazard from floating ice or freezing water spray.

§ 61.44 *Night operation over water.* No single-engine aircraft shall be operated at night with passengers.

§ 61.51 *Day operation over land.* No multiengine seaplane shall be operated over land more than 50 miles from open water suitable for a landing.

§ 61.52 *Night operation over land.* No multiengine seaplane shall be operated at night over land with passengers, nor shall any such seaplane be operated at night over land with goods more than 50 miles from open water suitable for a landing.

§ 61.53 *Day and night operation over water.* The following rules will govern the operation of multiengine aircraft in day or night operation over water:

(a) Multiengine land aircraft operated over water, beyond gliding distance from shore without the aid of power, shall be completely equipped for overwater flying as specified in § 40.59 (a), unless the overwater operations are so limited in duration or otherwise that the Administrator finds such equipment unnecessary.

(b) No multiengine aircraft shall be operated over water unless such aircraft can, at all times, maintain an altitude of at least 1,000 feet above the water, with any one engine inoperative and with the authorized load for the route or part thereof.

(c) No multiengine seaplane shall be operated over water except during such time and seasons as permit take-off and landing without any hazard from floating ice or freezing water spray, at terminals and intermediate stops.

(d) When one engine fails in a twin-engine land aircraft operating over water, the aircraft shall be headed toward, and thereafter continuously flown toward, a point on the nearest shore in terms of time where a safe landing may be made.

[CAR, May 31, 1938, as amended by Amdt. 129, 6 F. R. 4691, Amdt. 61-3, 10 F. R. 4288]

EQUIPMENT

§ 61.61 *First-aid equipment.* No aircraft shall be operated in scheduled air transportation unless equipped with a conveniently accessible first-aid kit adequate for proper first-aid treatment of passengers and crew which shall contain medical equipment and supplies approved by the Administrator as suitable and sufficient for the category of operation involved.

[Amdt. 122, 6 F. R. 3826, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.62 *Seat belt sign.* An aircraft shall not be operated in scheduled air transportation unless a suitable means for warning passengers to fasten seat belts is provided.

[Amdt. 129, 6 F. R. 4691, as amended by Amdt. 130, 6 F. R. 4753]

§ 61.63 *Cockpit check list.* (a) The air carrier shall provide for each make and model aircraft a cockpit check list, approved by the Administrator, adapted to each operation in which the aircraft is to be utilized. An approved check list shall be installed in a readily accessible location in the cockpit of each aircraft and shall be appropriately used by the flight crew for each flight.

(b) The cockpit check list shall include procedures prior to starting engines, prior to take-off, prior to landing, and for power-plant emergencies.

[Amdt. 61-18, 13 F. R. 2160]

MAINTENANCE

§ 61.71 *General.* Each aircraft operated by a scheduled air carrier shall be maintained in a continuous condition of airworthiness, in accordance with accepted standards and practices, and the terms of the air carrier operating certificate.

[CAR, May 31, 1938, as amended by Amdts. 61-21 through 61-31, 7 F. R. 1414]

§ 61.72 *Organization.* A maintenance organization shall be set up by the air carrier and it shall be responsible for the continuous airworthiness of all aircraft, engines, propellers, accessories, and instruments, for the proper maintenance of adequate facilities, for the adequacy and competence of maintenance personnel, and for the preparation and dissemination of such maintenance reports as are required by the Administrator.

§ 61.73 *Supervision.* All phases of maintenance duties shall be adequately supervised by qualified mechanics, mechanics in charge, crew chiefs, or foremen.

§ 61.74 *Inspection.* An adequate inspection organization shall be set up by the air carrier and it shall be responsible for determining that all maintenance work conforms to minimum standards prescribed by the Civil Aeronautics Board as to workmanship, methods employed, and materials used, as provided in §§ 61.71-61.87. Each inspector shall hold a valid mechanic certificate for the category of inspection involved.

[CAR, May 31, 1938, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.75 *Workmanship.* Workmanship shall be at least equivalent to that generally accepted as conforming to good practice as related to the airworthiness of the aircraft or auxiliary equipment.

§ 61.76 *Methods.* Methods employed shall conform to those generally accepted as good practice. Insofar as they apply, the methods provided for in Part 18 of this subchapter shall be utilized.

§ 61.77 *Materials.* Materials used shall conform, when possible, to Army, Navy, or Part 18 of this subchapter specifications. In no case shall materials be used of physical properties less than those of the material used by the manufacturer of the equipment or component in question insofar as the airworthiness of such equipment or component is affected.

§ 61.78 *Mechanics.* An adequate staff of qualified mechanics and experienced artisans shall be employed by the air carrier and kept available for the performance of functions of maintenance and other duties which are reasonable and necessary to the safe and orderly operation involved. Each such mechanic and artisan shall be relieved of all air carrier duties for a period of at least 24 consecutive hours during each week of duty or equivalent thereof.

§ 61.79 *Training program.* A training program shall be maintained so that maintenance personnel may at all times be familiar with the duties required, with particular reference to the introduction into air transportation service of a new or unfamiliar equipment.

§ 61.80 *Distribution of personnel.* Sufficient maintenance personnel shall be stationed or provided for along the air carrier route and at such scheduled stops as may be deemed necessary by the Administrator to provide proper service to flight equipment and auxiliaries thereto.

§ 61.81 *Shops and facilities.* At least one general overhaul and maintenance shop containing adequate working space and facilities shall be provided for by the operator. Such shop shall be properly lighted, ventilated, and heated.

§ 61.82 *Stock.* An adequate quantity of spare parts and supplies shall be kept on hand or readily available at all times.

§ 61.83 *Adequate facilities.* Adequate facilities for the proper servicing, maintenance and repair of air carrier aircraft and auxiliary equipment shall be available at all points along the air carrier's route deemed necessary or advisable by the Administrator.

§ 61.84 *Inflammable material.* Including dope, gasoline, etc., shall be kept remote from that portion of shops where sparks or open flames present fire hazards, by their proximity.

§ 61.85 *Refueling requirements.* The following rules will govern the operations incident to the refueling of air carrier aircraft:

(a) Water elimination facilities shall be provided at all refueling points.

(b) A daily check for the presence of water in fuel and storage and dispensing tanks shall be made and a record of such water checks shall be kept, unless such tanks are equipped with an automatic water eliminator deemed satisfactory by the Administrator.

(c) Where refueling is accomplished during conditions of rain or snow, precautions shall be taken to prevent the entrance of moisture into the fuel tanks of the aircraft.

(d) During refueling the aircraft and the fuel dispensing apparatus shall both be grounded to a point or to points of zero electrical potential.

(e) When refueling is accomplished at night, adequate lights shall be provided to insure proper servicing.

(f) No smoking and no fires or flames shall be permitted in the immediate vicinity of an aircraft while refueling is being accomplished.

(g) When practicable, the aircraft electrical switches shall not be switched on or switched off while refueling is being accomplished.

(h) When passengers are permitted to remain in the cabin while refueling is being accomplished, a responsible cabin attendant shall remain in the cabin at or near the cabin door.

§ 61.86 *Alteration and repairs.* Air carrier aircraft, including training aircraft, aircraft engines, propellers, and approved components thereof, shall be altered or repaired only in conformity to the procedures provided in Part 18 of this subchapter. Reports of such alterations or repairs shall be submitted promptly to the Administrator through the air carrier maintenance inspector having supervision of the operation involved.

§ 61.87 *Records.* Current records shall be kept of the total time of service, the time since last overhaul, and time since last inspection, on all aircraft, engines, propellers, and where practicable on instruments, equipment, and accessories. Current records shall be kept of all instrument and equipment failures, including partial ones, which occur to the aircraft after it has departed from the block until it has reached the next block.

A new record may be used in the case of propellers for which there is no previous operating history, if the propeller hub is rebuilt by a certificated repair station having the proper rating or by the manufacturer, and new propeller blades or propeller blades with complete operating history are installed therein. The new record must be signed by the manufacturer or by the repair agency, giving the date the propeller was rebuilt and such other information as the Administrator may require.

[CAR, May 31, 1938, as amended by Amdt. 61-4, 10 F. R. 9771]

MAINTENANCE MANUAL

§ 61.91 *Necessity.* In order properly to maintain flight equipment, each operator of a scheduled air carrier shall prepare and maintain a maintenance manual for the use and guidance of the maintenance personnel.

§ 61.92 *Contents.* Each maintenance manual shall outline instructions for operations covering the overhaul, check, inspection, and servicing of flight equipment and other equipment auxiliary thereto, and shall also contain a copy of that portion of the air carrier operating certificate pertaining to maintenance. The responsibilities of each mechanic in charge, crew chief, foreman, and inspector shall be clearly outlined.

[CAR, May 31, 1938, as amended by Amdts. 61-21 through 61-31, 7 F. R. 1415]

§ 61.93 *Form.* The maintenance manual shall be loose-leaf in form and each page therein shall be numbered and dated to show the currency of all material contained therein. All copies of such manual shall at all times be kept up to date.

§ 61.94 *Delivery of copies.* A copy of the maintenance manual shall be furnished to at least the following persons:

(a) The Administrator of Civil Aeronautics.

(b) The Chief, Air Carrier Service, Civil Aeronautics Administration.

(c) Each air carrier maintenance inspector of the Administrator in charge of inspection of any part of the air carrier,

(d) Each chief of maintenance of the air carrier,

(e) Each chief inspector of the air carrier, and

(f) Each mechanic of the air carrier in charge at each station where servicing, inspection, checks, or overhauls is or are done.

§ 61.95 *Record of copies.* Each air carrier shall keep a complete record of all persons to whom copies of its maintenance manual have been supplied.

§ 61.96 *Changes.* The following rules will govern changes made in the maintenance manual:

(a) Any change issuing from the Administrator pertaining to the maintenance manual shall be promptly incorporated in the maintenance manual and a copy thereof sent, in the form of a new page of such manual, to each person required to hold a copy of the manual. Each amended page of the manual shall be properly dated.

(b) Upon receipt of such amended page or pages the recipient shall insert the current information in the manual.

(c) No change shall be made in any overhaul, check, or inspection periods without the approval in writing of the Administrator. Pages of the manual shall be changed accordingly. Notice of such changes shall be promptly given in accordance with paragraph (a) of this section.

(d) Any data not issuing from the Administrator may be changed by the operator without the approval of the Administrator, provided such change is not inconsistent with any Federal regulation, the air carrier operating certificate, or safe maintenance practice. Notice of such change shall be promptly given in accordance with § 61.96 (a).

[CAR, May 31, 1938, as amended by Amdts. 61-21 through 61-31, 7 F. R. 1415]

§ 61.97 *Retirement of parts program.* A retirement of parts program shall be set up by the operator based upon the experience of the operator and the best information available including recommendations from the original manufacturer of the equipment.

AIRMEN

§ 61.101 *Airmen utilization.* No scheduled air carrier shall utilize any dispatcher or flight crew member in scheduled air transportation until such airman has met the appropriate qualifications and requirements prescribed by the regulations of this subchapter.

[Amdt. 61-6, 12 F. R. 3171]

§ 61.101-1 *"Flight crew member" (CAA interpretations which apply to § 61.101).* A "flight crew member" is defined as "a pilot, flight radio operator, flight engineer, or flight navigator assigned to duty on the aircraft" (§ 41.137 (i)).

[12 F. R. 5609]

§ 61.102 *Airmen records.* Each scheduled air carrier shall maintain such current records of dispatchers and flight crew members utilized by the air carrier in scheduled air transportation at such points on its routes as the Administrator may designate. These records shall contain such information concerning the qualifications of each airman as is necessary to show compliance with the appropriate qualifications and requirements prescribed by the regulations of this subchapter. No scheduled air carrier shall utilize in scheduled air transportation any dispatcher or flight crew member unless records are maintained for such airman as required herein.

[Amdt. 61-6, 12 F. R. 3171]

§ 61.102-1 *Content of airmen records (CAA rules which apply to § 61.102).* (a) The following information must be maintained accurately and currently in the airmen records: (1) Name (full); (2) current duties and date of assignment (Pilot in Command, Flight Engineer, etc.); (3) Airman Certificates (category, certificate number and ratings); (4) date, result, and class of last physical examination of all flight crew members; (5) date and result of last six months' instrument competency flight check for pilots in command; (6) routes over which dispatchers and applicable flight crew members are currently qualified, together with qualification records, grades, and dates; (7) record of pilot in command's flight time, including instrument flight time and flight time in the type of aircraft on which he is currently qualified; (8) record of company training for all pilots, including actual flight, synthetic flight, and maintenance of proficiency training; (9) any check pilot authorization (§ 61.134), and (10) any information on the individual considered desirable in these records by the air carrier as to special qualifications, duty assignment, etc.

(b) These records must (1) be available at any time for reference and inspection by authorized representatives of the Administrator of Civil Aeronautics, for the determination of compliance with appropriate qualifications and requirements prescribed in this subchapter, (2) indicate the disposition of any dispatcher or flight crew member who is released from the employ of the air carrier, or who becomes physically or professionally disqualified, and (3) be retained by the company for at least six months.

[CAA Rules, 12 F. R. 5609, as amended by Amdt. 61-4, 14 F. R. 2199. Corrections noted at 14 F. R. 38]

PILOT IN COMMAND

§ 61.110 *Aircraft commander.* The pilot in command shall be in command of the aircraft at all times during flight, and shall be responsible for the safety of persons and goods carried, and for the conduct and safety of the members of the crew.

[CAR, May 31, 1938, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.111 *Aircraft competency.* The pilot in command shall meet the requirements of Parts 40 and 61 of this subchapter with respect to the aircraft to be operated in scheduled air transportation.

[Amdt. 61-6, 12 F. R. 3171, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.112 *Instrument competency.* The pilot in command, in addition to meeting the minimum requirements for an instrument rating provided for in § 20.42 of this subchapter, and appropriate provisions of Part 21 of this subchapter, as the case may be, must prove satisfactorily to the operator's check pilot, within forty-five days prior to the end of every six-month period after entry into the service in accordance with the training program required by §§ 61.131 to 61.135, his ability to pilot and navigate by instruments an aircraft of a type to be flown by him in the air carrier service. Additional checks may be required by the Administrator at his discretion.

[Amdt. 61-35, 7 F. R. 3357, as amended by Amdt. 61-37, 7 F. R. 6632, Amdt. 61-5, 10 F. R. 10165, Amdt. 61-4, 14 F. R. 2199]

§ 61.113 *Route competency.* No pilot in command shall be deemed competent over any route or part thereof unless he has met the appropriate minimum requirements of Part 40 of this subchapter and has maintained his route competency as provided in this part.

[Amdt. 61-6, 12 F. R. 3171, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.114 *Maintenance of pilot route qualification.* After 12 consecutive months' absence from flight duty over a route or part thereof a pilot in command will no longer be deemed competent for the carriage of persons in air transportation service over such routes or part thereof unless he has requalified in accordance with the provisions of § 40.87 (b) of this subchapter.

[Amdt. 61-8, 11 F. R. 5646, 5779, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.115 *Logging flight time.* A pilot in command shall log the total actual flight time elapsing during his command of the aircraft.

[CAR, May 31, 1938, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.116 *Logging instrument flight time.* Instrument flight time may be logged as such only when the aircraft is flown solely by reference to instruments either under actual or properly simulated flight conditions. (Over-the-top flying shall not be logged as instrument flight time.)

§ 61.117 *Flight time limitations.* The following rules prescribe the flight time limitations for all pilots in scheduled air transportation:

(a) A pilot may be scheduled to fly 8 hours or less during any 24 consecutive hours, without a rest period during such 8 hours. If such pilot be scheduled to fly in excess of 8 hours during any 24 consecutive hours, he shall be given an intervening rest period at or before the termination of 8 scheduled hours of flight duty. Such rest period shall equal at least twice the number of hours flown since the last preceding rest period and in no case shall such rest period be less than 8 hours. During such rest period, the pilot shall be relieved of all duty with the air carrier.

(b) When a pilot has flown in scheduled air transportation service in excess of 8 hours during any 24 consecutive hours, he shall receive 24 hours of rest before being assigned any duty with the air carrier. Time spent in deadhead transportation to duty assignment shall not be considered part of such rest period.

(c) A pilot shall not fly in excess of 30 hours during any 7 consecutive days. Relief from all duty for not less than 24 consecutive hours shall be provided for and given to such pilot at least once during any 7 consecutive days.

(d) A pilot shall not fly in scheduled air transportation service as a member of the crew more than 100 hours in any one month: *Provided,* That the Administrator is authorized, during the present war and until 6 months after the termination thereof, to permit the maximum of 100 hours to be exceeded to the extent necessary to complete a particular flight for military purposes.

(e) A pilot shall not fly in scheduled air transportation service as a member of the crew more than 1,000 hours in any one calendar year: *Provided,* That this limitation shall not be effective during the present war and until 6 months after the termination thereof, and that during this period the maximum flying hours permitted in any one calendar year shall be controlled by the provisions of paragraph (d) of this section.

(f) The foregoing flight time limitations shall not be applicable when a pilot is qualifying on a regular route, or alternate route, over which such pilot is not qualified.

(g) A pilot shall not do other commercial flying while employed by an air carrier when such flying, in addition to that in scheduled air transportation service, will exceed any flight time limitations specified in this section.

[Amdt. 61-39, 7 F. R. 7478]

COPILOT

§ 61.121 *When required.* A copilot will be required in the following cases when passengers are carried:

(a) When the aircraft used is of a design incorporating multiengine features, combined with retractable landing gear or wing flaps or of a single-engine design incorporating both retractable landing gear and wing flaps, or

(b) When the pilot in command is required to fly 5 or more hours during any 24 consecutive hours without an intervening rest period equal to at least 2 hours for each hour flown since the last preceding rest period. Such rest period when required shall not be less than 8 hours, or

(c) When the operation authorized permits instrument flying, or

(d) When, in the opinion of the Administrator, the usual and customary duties of a pilot in command in the navigation and conduct of a flight would be unduly interfered with through the necessity of performing other duties usually performed by a copilot.

[CAR, May 31, 1938, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.122 *Aircraft competency.* A copilot shall meet the minimum requirements prescribed in § 40.88 of this subchapter.

[CAR, May 31, 1938, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.123 *Instrument competency.* At least once each 6 months after entry into service as a copilot, each copilot shall have his logbook certified to the effect that he is capable of flying by instruments and has demonstrated such fact to a pilot in command, check pilot, or to the chief pilot of the air carrier, which person shall so certify.

[CAR, May 31, 1938, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.124 *Logging flight time.* (a) A copilot possessed of an airline transport pilot certificate and an appropriate rating for the aircraft flown, may log the total flight time during which he is on duty as copilot.

(b) A copilot not possessed of an airline transport pilot certificate and an appropriate rating for the aircraft flown may log 50 percent of the total flight time.

[Amdt. 61-4, 14 F. R. 2199]

PILOT TECHNIQUE MAINTENANCE

§ 61.131 *Responsibility of operator.* In order to maintain a high standard of pilot technique, the air carrier shall be responsible for proper and periodic instruction, in their respective duties, of all pilots in command and copilots employed by such operator. The instruction so given to pilots in command shall at least include operation and approach for landing with one engine fully throttled with maximum load authorized for the route or portion thereof, in each category of aircraft to be used by the pilot in scheduled air transportation service, and instrument approach procedures.

[CAR, May 31, 1938, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.132 *Continuance of pilot competency.* If, within any 90-day period, a pilot in command or copilot has not made at least two take-offs and landings in scheduled air transportation in aircraft of a particular type, such person shall not thereafter serve or be employed to serve as a pilot in command or copilot in aircraft of that type in such transportation without having made at least three take-offs and landings in such aircraft with one-half to three-fourths useful load, and, if he is to serve in such transportation at night, without having made at least one of the three take-offs and landings at night. No person shall be carried during such three take-offs and landings other than personnel of the air carrier or other air carriers and inspectors of the Administrator.

[Amdt. 129, 6 F. R. 4691, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.133 *Pilot certification for equipment.* When such tests are not conducted by the Administrator of Civil Aeronautics air carrier inspector, an authorized check pilot shall certify to the pilot's capabilities on the equipment involved.

§ 61.134 *Check pilots.* Each air carrier shall provide a sufficient number of check pilots to insure that each pilot constantly meets and complies with the minimum pilot requirements pertaining to scheduled air transportation service. No check pilot so provided by the operator shall check any pilots in command for the air carrier until such check pilot has been approved therefor by the Administrator. No check of pilot capabilities made in behalf of the air carrier abrogates the authority of the Administrator to make whatever pilot checks are deemed by him to be necessary in the interests of safe air carrier operation.

[CAR, May 31, 1938, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.135 *Training program.* A pilot training and instruction program satisfactory to the Administrator shall be maintained by the air carrier. The operator shall submit it to the Administrator within 60 days after certification of the air carrier.

§ 61.135-1 *Pilot training and instruction program (CAA rules which apply to § 61.135)*—(a) *Ground training.* The ground phase of the air carrier's pilot training and instruction program must include (1) a study of the regulations in this subchapter applicable to scheduled air carrier (domestic) operations, and of the provisions of the air carrier's operating certificate, placing emphasis on knowledge of those sections of Part 61 pertaining to the operation of transport category aircraft, and on the methods and principles of determining weight limitations for landings and take-offs; (2) a study of the company's operations manual and dispatch procedures; (3) training in the duties and responsibilities of flight crew members; (4) thorough familiarization with the aircraft to be flown, including a thorough study of the aircraft, engines, all major component systems, operation of cabin pressurization and oxygen systems, and standard operating procedures; a study of Civil Aeronautics Administration approved Airplane Flight Manual and familiarity with its contents; (5) the study of navigation; use of radio aids to navigation and such refresher courses necessary to keep pilots current in the application of any new developments; (6) a study of meteorology sufficient to maintain a practical knowledge of the principles of icing, fog, thunderstorms, frontal systems, etc., and the best methods of operating under these various conditions.

(b) *Flight training.* The flight phase of the training program shall be so planned as to insure adequate initial qualification of the pilot on the type aircraft he is to fly on scheduled operations. It shall also provide for continued maintenance of a high standard of pilot proficiency. This training must include (1) take-offs and landings under varying conditions of load, wind, etc.; (2) flight with one or more engines inoperative, including flight with any one engine fully throttled and at maximum authorized load either at the one-engine-inoperative service ceiling or at an altitude equivalent to 1,000 feet above the highest part of the terrain on the proposed instrument course or route to be flown by the pilot in scheduled operation; (3) operating under normal and maximum limits of power, speed, etc.; (4) conduct of instrument flight under simulated condition, including navigation by low frequency radio range, very high frequency visual-aural range, omni-directional range, automatic direction finder, etc., letting-down-through procedures utilizing radio range, ADF, ILS, GCA, etc., whichever of the navigation and letting-down-through procedures are used by the air carrier in the course of its normal operation.

(c) *Emergency procedures.* A satisfactory pilot training program shall place special emphasis on instruction in emergency procedures. This shall include the procedures to be followed in the event of engine failure, fire in the air or on the ground, evacuation of passengers, location and operation of all emergency equipment, power settings for maximum endurance and maximum range, etc.

(d) *General.* The purpose of a pilot training program is to assure that the pilots are thoroughly trained and proficient in the aircraft, equipment, techniques and procedures to be used by them in scheduled air transportation. The effectiveness of pilot training programs will be evaluated by the Civil Aeronautics Administration on the basis of pilot proficiency.

[Supp. 5, 13 F. R. 2849, as amended by Amdt. 61-4, 14 F. R. 2199. Correction noted at 14 F. R. 38]

RADIO OPERATOR

§ 61.141 *Certificate.* Effective November 15, 1947, each flight radio operator shall hold a valid flight radio operator certificate issued in accordance with the provisions of Part 33 of this subchapter: *Provided,* That a pilot in command or copilot, holding an appropriate Federal Communications license, may serve in the capacity of a radio operator where a certificated flight radio operator is not specifically required.

[Amdt. 61-5, 12 F. R. 3030, as amended by Amdt. 61-4, 14 F. R. 2199]

DISPATCHERS

§ 61.151 *Number required.* The air carrier shall provide an adequate number of certificated aircraft dispatchers, necessary for the type of operation involved, for the purpose of dispatching air carrier aircraft.

[CAR, May 31, 1938]

§ 61.152 *Location.* One or more aircraft dispatchers shall be located at such points as may be deemed necessary by the Administrator to insure the safe operation of the air carrier.

[Amdt. 51, 5 F. R. 1839]

§ 61.153 *Dispatcher competency.* Each dispatcher used by a scheduled air carrier to dispatch aircraft in scheduled air transportation shall be possessed of a currently effective dispatcher certificate and shall be qualified over the route or routes over which he dispatches aircraft as provided in this part.

[Amdt. 61-6, 12 F. R. 3171]

§ 61.154 *Qualification for route.* The following rules shall govern the qualification of a dispatcher for a particular route:

(a) He shall have made at least one round trip over the route, or part thereof, on which he is to serve during the previous 90 days prior to dispatching any airplane over such route or part thereof.

(b) He shall observe and be familiar with the prevailing weather phenomena peculiar to the route, or part thereof, for which qualification is sought.

(c) He shall be familiar with the air carrier operation over the route, or part thereof, for which qualification is sought.

(d) He shall be familiar with the contents of the air carrier operations manual.

(e) He shall be familiar with all portions of the air carrier operating certificate pertaining to en route operations and airport specifications for the route or part thereof for which qualification is sought.

(f) He shall be familiar with the general and special rules of the air carrier concerning dispatch of aircraft in scheduled operations.

(g) He shall be familiar with the aircraft used by the air carrier.

(h) He shall be familiar with the provisions of the aircraft certificates and with the loading charts for the equipment used.

(i) He shall be familiar with the maximum authorized loads, with respect to the route or part thereof, for the aircraft to be used.

(j) He shall be familiar with the fuel and oil consumption of the aircraft, with respect to the air carrier operating conditions.

(k) He shall be familiar with the available charts used to compute the air speed of the aircraft and the fuel consumption, at various altitudes and power outputs of the aircraft engines.

(l) He shall be familiar with the local United States Weather Bureau and Civil Aeronautics Authority personnel.

(m) He shall be familiar with the radio facilities in the aircraft used.

(n) He shall be familiar with the peculiarities and limitations of each radio range and radio marker station over the route, or part thereof, for which route competency is sought.

(o) He shall be familiar with the effect of weather conditions upon the radio reception by the aircraft to be used.

(p) He shall be familiar with the timetables which ordinarily apply to the air carrier operation.

(q) He shall be familiar with any airway facility, additional to those mentioned in paragraph (n) of this section en route, to, or located at, alternate airports approved as such, for the route or part thereof, in the air carrier operating certificate.

[CAR, May 31, 1938, as amended by Amdts. 61-21 through 61-31, 7 F. R. 1415]

§ 61.155 *Maintenance of qualifications.* Each dispatcher used by a scheduled air carrier to dispatch aircraft in scheduled air transportation shall maintain his familiarity with the route or routes over which he dispatches aircraft in scheduled air transportation and with the items set forth in § 61.154 (b) through (q).

[Amdt. 61-6, 12 F. R. 3171]

§ 61.156 *Minimum specifications.* A dispatcher shall not dispatch visual-contact, instrument, or over-the-top flights, either day or night, below the respective minimum specified for such flights in the air carrier operating certificate, except as provided in § 61.203 (b).

[CAR, May 31, 1938, as amended by Amdts. 61-21 through 61-31, 7 F. R. 1415, Amdt. 61-19, 6 F. R. 6015]

§ 61.157 *Dispatcher route qualification expiration.* After 24 consecutive months' absence from dispatching duty over a route or part thereof, a dispatcher will no longer be deemed qualified to dispatch aircraft in scheduled operations over such route or part thereof.

§ 61.158 *Dispatcher time limitations.* The following rules will govern the hours of duty for authorized dispatchers:

(a) *Maximum consecutive hours of duty.* No dispatcher shall be on duty as such for a period of more than 10 consecutive hours.

(b) *Maximum hours of duty in 24 consecutive hours.* If a dispatcher is scheduled to be on duty as such for more than 10 hours in a period of 24 consecutive hours, he shall be given a rest period of not less than 8 hours, at or before the termination of 10 hours of dispatcher duty except in emergencies due to illness or unavoidable absence of a dispatcher due to weather during a qualification trip or other circumstances beyond the control of the operator.

(c) *Dispatcher's time off.* Relief from all duty with the air carrier for not less than 24 hours shall be provided for and given each dispatcher at least once during any consecutive 7 days, or equivalent thereto within 1 calendar month.

FLIGHT ENGINEER

§ 61.161 *Flight engineer; when required.* (a) After December 1, 1948, an airman holding a flight engineer certificate shall be required on all four-engine aircraft certificated for more than 80,000 pounds maximum take-off weight, and on all other four-engine aircraft certificated for more than 30,000 pounds maximum take-off weight where the Administrator finds that the design of the aircraft used or the type of operation is such as to require a flight engineer for the safe operation of the aircraft.

(b) The requirement of paragraph (a) of this section shall not be satisfied by the performance of multiple functions at the same time by any airman.

[Amdt. 61-3, 13 F. R. 5910]

§ 61.162 *Certificate.* Effective November 15, 1947, each flight engineer shall hold a valid flight engineer certificate issued in accordance with the provisions of Part 35 of this subchapter.

[Amdt. 61-4, 12 F. R. 1920 as amended by Amdt. 61-9, 12 F. R. 6286]

§ 61.163 *Qualification for duty.* A certificated flight engineer shall not be assigned to nor perform duties for which he is required to be certificated unless, within the preceding 12-month period, he has had at least 50 hours of experience as a flight engineer on the type aircraft on which he is to serve; or until the air carrier has checked the airman and determined that he is (a) familiar with all current information and operating procedures relating to the type aircraft to which he is to be assigned and (b) competent with respect to such aircraft.

[Amdt. 61-10, 12 F. R. 6378, as amended by Amdt. 61-4, 14 F. R. 2199]

WEATHER

§ 61.171 *Reports.* The following rules shall govern the use of weather reports by scheduled air carriers:

(a) No weather report shall be used to control flight movements unless prepared from observations made and released by the United States Weather Bureau, or by a source approved by such Bureau including pilots' flight observation reports.

(b) The weather reports used shall be the latest reports available.

(c) The last airway weather report entered upon the clearance form or attached thereto shall be not more than 1 hour and 30 minutes old at the time the aircraft departs on a scheduled flight, except that off-course weather reports or on-call weather reports may be entered thereupon or attached thereto if the last such report is not more than 2 hours old.

CROSS REFERENCE: For special regulation permitting noncompliance with the paragraph in the case of flights of scheduled air carriers at certain altitudes, see Regulations, Serial No. SR-331, appearing as a note preceding the text of Part 40.

(d) Barometric pressures, corrected to sea level readings, shall be utilized exclusively.

(e) All ceiling heights, reported by pilots in flight either by radio or by entry on forms, shall be with reference to altitude above sea level.

(f) Forecasts made by Weather Bureau or company meteorologists, or both, may be used.

[CAR, May 31, 1938, as amended by Amdt. 61-41, 7 F. R. 8414]

FLIGHT OPERATIONS

PRIOR TO CLEARANCE

§ 61.181 *Aircraft to be airworthy.* No scheduled air carrier shall operate any aircraft unless, at the time of use, the aircraft is in an airworthy condition, conforms with the terms of its current aircraft certificate, and is loaded in conformity with the current loading schedule which is a part of such certificate.

§ 61.182 *Adequately serviced.* Before departure on any flight, the air carrier aircraft shall be adequately serviced. The pilot in command shall be responsible for the proper servicing of the aircraft, although he may delegate supervision of the actual work to a copilot or other certificated airman.

[CAR, May 31, 1938, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.183 *Adequate fuel supply.* The following rules shall govern the minimum fuel supply to be carried by all air carrier aircraft:

(a) *Visual-contact operation (day or night).* No air carrier aircraft shall be dispatched or shall take off without fuel and oil sufficient, considering the wind and other weather conditions to be encountered during the course of the flight, to complete flight to the first point of landing specified in the clearance, and thereafter to fly for a period of at least 45 minutes at normal cruising consumption for the flight.

(b) *Instrument or over-the-top operation (day or night).* No air carrier aircraft shall be dispatched or shall take off without fuel and oil sufficient, considering the wind and other weather conditions to be encountered during the course of the flight, to complete such flight to the next point of landing specified in the clearance; and thereafter:

(1) To fly to and land at the alternate airport for such point designated in the clearance which is most distant from such point, and thereafter

(2) To fly for a period of at least 45 minutes at normal cruising consumption for the flight.

[CAR, May 31, 1938, as amended by Amdt. 129, 6 F. R. 4692]

§ 61.184 *Radio ground check.* Immediately preceding departure from originating station it shall be determined that both day and night frequencies of the two-way radio, as well as all additional frequencies whose use are contemplated during the flight, are working satisfactorily. The method of determining this shall be by radio contact on each frequency with at least one ground station.

§ 61.185 *Passengers aboard during refueling.* Passengers may be permitted to remain in the cabin during refueling: *Provided,* That

(a) There is no smoking in the aircraft, and

(b) There is no smoking on the ground in the vicinity of the aircraft, and

(c) An employee of the operator is stationed in the entrance to the passenger cabin and remains there alert for any emergency until refueling is completed.

§ 61.186 *Notice of other aircraft in flight on route (outside of airway traffic control area).* Immediately prior to departure it shall be the responsibility of the dispatcher dispatching an instrument flight outside of an airway traffic control area to ascertain from the best information available what other aircraft flights affecting the flight are in progress over the route between clearance points, the results of which shall be made known to the pilot. After departure of the scheduled flight the dispatcher will continue to advise his flight or flights the progress of all other known aircraft in flight on the course, crossing courses, converging courses, etc., affecting the flight.

DISPATCHING RULES (FOR CLEARANCE)

§ 61.191 *Necessity for dispatching authorization.* No scheduled air carrier flight shall be started except on the authority of an aircraft dispatcher qualified for the route, or part thereof, on which the flight takes off. No such authority is required for take-offs from an intermediate stop between points specified in the original clearance unless the flight has been delayed for any reason more than 30 minutes.

[Amdt. 129, 6 F. R. 4692, as amended by Amdts. 61-21 through 61-31, 7 F. R. 1415 and Amdt. 61-6, 12 F. R. 3171]

§ 61.192 *Dispatcher reporting for duty.* No dispatcher shall clear a flight of air carrier aircraft unless he has been on duty, at the station from which such clearance is effected, for a period sufficient to become familiar with existing conditions. He shall continue on duty until the aircraft has landed in completion of a trip, or until the dispatching supervision has been taken over by an adjacent air carrier dispatcher or by another dispatcher who has relieved him after such relief dispatcher has been on duty for a period sufficient to become familiar with existing conditions.

§ 61.193 *Clearance and load manifest forms.* The clearance and load manifest forms used shall be approved by the Administrator. The original copies of such forms shall be given to the pilot in command and duplicate copies kept in the station file for at least 30 days.

[Amdt. 61-7, 12 F. R. 4667, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.194 *Preparation of clearance form.* A clearance form shall be prepared for each flight between specified clearance points. The information for such clearance shall be prepared by the authorized aircraft dispatcher of the air carrier operating the aircraft. This form shall be signed by the pilot in command and by the authorized aircraft dispatcher only when both believe the flight may be made with safety. The authority to sign such clearance may be delegated for a particular flight by the authorized aircraft dispatcher, but the authority to dispatch cannot be delegated and such dispatcher remains responsible for the dispatch and continued supervision of the flight.

[Amdt. 61-7, 12 F. R. 4667, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.195 *Preparation of load manifest form.* A manifest form showing the loading of the aircraft shall be prepared and signed for each flight by qualified personnel of the air carrier charged with the duty of supervising the loading of the aircraft and the preparation of the load manifest forms, or by qualified persons authorized by the air carrier. The aircraft when loaded shall not exceed the center of gravity limits or maximum allowable weight limits set forth in the aircraft certificate for the particular aircraft.

[Amdt. 61-7, 12 F. R. 4667]

§ 61.196 *Clearance and load manifest contents.* The following rules will govern the clearance and load manifest contents:

(a) The clearance shall contain or have attached thereto all current weather reports as outlined in § 61.171 over the airway or part thereof and, when available, any off-airway or on-call weather reports considered necessary or desirable by the pilot or dispatcher to insure the safety of the flight.

(b) When available, the latest terminal and airway forecasts shall be included in or attached to the clearance and shall be considered by the dispatcher responsible and pilot in command before clearance.

(c) The dispatcher or duly authorized station personnel shall attach or enter all current reports or information pertaining to weather and irregularities of navigational aids and facilities and aircraft instruments and equipment affecting the flight. He shall also inform the pilot, during flight, of any additional or different irregularities, and the flight shall be controlled accordingly.

(d) The load manifest shall be completed or kept current at each intermediate stop.

[CAR, May 31, 1938, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.197 *Clearance request repetition.* When a pilot requests clearance from a dispatcher authorized to clear the proposed flight and is refused such clearance, he shall not make a similar request from another dispatcher.

§ 61.198 *Change in clearance by radio.* If a change in clearance is desirable while the aircraft is in flight, the pilot may be given a change in clearance by radio by an authorized dispatcher: *Provided*, The two-way conversation appears in the radio log. If the pilot is refused such change by one dispatcher, he shall not make a similar request of another dispatcher. No aircraft shall be recleared en route for instrument flight after clearance for contact flight with any one instrument or unit of equipment not in serviceable condition as provided for in § 61.208.

§ 61.199 *Weather minimums; general.* The following rules relating to weather conditions will govern the dispatching of air carrier aircraft.

(a) No scheduled air carrier aircraft shall be dispatched unless, at the time of take-off, the ceiling and visibility at the point of departure are equal to or better than those specified for departure in the air carrier operating certificate.

(b) In the event of ground fog, the dispatcher shall comply strictly with the pertinent procedures specified in the air carrier operating certificate with respect to take-offs and landings.

[CAR, May 31, 1938, as amended by Amdts. 61-21 through 61.31, 7 F. R. 1415]

§ 61.200 *Weather minimums; visual-contact clearance.* The following rules relating to weather conditions will govern the dispatching of air carrier aircraft in visual-contact operation. No scheduled air carrier aircraft shall be dispatched unless:

(a) The hourly weather report sequence and current weather forecasts shall show a trend that gives sufficient indication that the ceilings and visibilities along the route to be flown are and will remain at or above the minimums specified in the air carrier operating certificate until the flight arrives at the point cleared to.

(b) During day operation minimum visibility shall be 1 mile except contact flight may be made when visibility is reduced to one-half mile by local smoke, dust, haze, blowing snow, or sand.

(c) During night operation at least one beacon on the course shall be visible from the aircraft at all times, unless otherwise specifically authorized by the Administrator.

[CAR, May 31, 1938, as amended by Amdt. 51, 5 F. R. 1839, Amdts. 61-21 through 61-31, 7 F. R. 1415]

§ 61.201 *Instrument or over-the-top clearance.* The rules in §§ 61.202–61.204 with respect to weather conditions shall govern the dispatch of air carrier aircraft in air transportation for instrument or over-the-top flight.

[Amdt. 129, 6 F. R. 4692]

§ 61.202 *Weather conditions at terminal or intermediate airports.* Air carrier aircraft shall not be dispatched in air transportation unless:

(a) The observed weather information and current weather forecasts, pertaining to all landing points specified in the clearance, give sufficient indication at the time of clearance that the ceilings and visibilities are, or will be, when the flight would arrive at such point or points, at or above the minimums specified in the air carrier operating certificate for letting-down-through; and

(b) The alternate airports required by § 61.203 are specified.

[Amdt. 129, 6 F. R. 4692, as amended by Amdts. 61-21 through 61-31 7 F. R. 1415]

§ 61.203 *Alternate airport requirement.* (a) When the observed weather information and current weather forecasts pertaining to a landing point specified in the clearance indicate, at the time of clearance, that the ceiling and visibility are, and will remain until the flight would arrive at such point, at or above the minimums specified in the air carrier operating certificate for letting-down-through, there shall be at least one alternate airport specified on the appropriate flight clearance for such point.

(b) When, at the time of clearance, the ceiling or visibility at a landing point specified in the clearance is below the minimums specified in the air carrier operating certificate for letting-down-through, but the weather reports pertaining to such point at the time of clearance show a trend, by the hourly sequence and current forecasts, that indicates that the weather conditions will improve to or above such minimums upon arrival of the flight at such point, two alternate airports shall be specified in the appropriate flight clearance for such point.

[Amdt. 129, 6 F. R. 4692, as amended by Amdts. 61-21 through 61-31, 7 F. R. 1415]

§ 61.204 *Types of alternate airports.* (a) If an alternate referred to in § 61.203 is equipped with a radio range, the weather conditions existing thereat at the time of clearance must be equal to, or above, the ceilings and visibilities specified in the air carrier operating certificate for letting-down-through at such airport when using it as an alternate airport, and the hourly weather report sequence and current forecasts shall show a trend that indicates that such weather conditions will continue or improve at such alternate airport until the flight shall arrive thereat. The weather minimums at such alternate airport shall in no case be less than one of the following:

(1) A ceiling of 1,000 feet and visibility of 1 mile;

(2) A ceiling of 900 feet with a visibility of 1½ miles; or

(3) A ceiling of 800 feet with a visibility of 2 miles.

(b) If an alternate referred to in § 61.203 is not equipped with a radio range, the weather conditions existing thereat, at the time of clearance, must be equal to, or better than, broken clouds and a ceiling of 1,000 feet and a visibility of 2 miles, and the hourly weather report sequence and forecasts shall show a trend that gives sufficient indication of weather conditions continuing or improving until the flight shall arrive thereat: *Provided*, That the Administrator may, in the interest of safety, prescribe higher minimums at individual airports.

[Amdt. 129, 6 F. R. 4692, as amended by Amdts. 61-21 through 61-31, 7 F. R. 1415]

§ 61.205 *Clearance of flights from alternate airports.* Clearance of flights from an alternate airport over an unauthorized route to an airport on an authorized route shall not be permitted unless the flights can be made in accordance with the provisions of § 61.22.

[Amdt. 61-10, 11 F. R. 5646]

§ 61.206 *Late or off-schedule flights.* When variations from the regular schedules occur, the dispatcher shall take such action or issue such special orders as may be necessary and proper.

§ 61.207 *Flight hazards.* No scheduled air carrier flight shall be dispatched when, in the opinion of either the pilot in command or the dispatcher, such flight cannot be completed with safety. No scheduled air carrier flight shall be continued toward any point cleared to when, in the opinion of either the pilot in command or the dispatcher, such continuation cannot be completed with safety unless, in the opinion of either, there is no safer method of procedure. In the latter event continuation shall constitute an emergency situation (see §§ 61.253, 61.310).

[CAR, May 31, 1938, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.208 *Flight equipment.* An air carrier shall not dispatch an aircraft in air transportation unless the equipment required by this chapter for the particular type of operation involved, is installed in such aircraft and in serviceable condition and, if any part of such equipment becomes unserviceable in flight, a landing shall be made either at the nearest suitable landing area where a safe landing may be made or, at the next point of intended landing, whichever in the opinion of the pilot and dispatcher is the safest procedure: *Provided*, That the aircraft dispatcher in control of the flight may dispatch or authorize the operation of such aircraft in air transportation to the nearest point where repair or replacement of such equipment can be made if the equipment specified in §§ 61.209–61.212 for the particular category of operation involved is installed in such aircraft and in serviceable condition.

[Amdt. 51, 5 F. R. 1839, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.209 *Visual-contact day operation.*
(a) One air-speed indicator.
(b) One altimeter.
(c) One tachometer for each engine.
(d) One oil pressure gauge for each engine.
(e) One oil temperature gauge for each engine.
(f) One manifold pressure gauge for each engine.
(g) One safety belt for each person aboard.
(h) (1) In passenger service, a minimum of two hand fire extinguishers of an approved type with an approved extinguishing agent, one of which is installed in the crew compartment, others readily accessible to the passengers. Such additional hand fire extinguishers as the Administrator finds necessary for compliance with § 61.31 (b) (2).
(2) In cargo service, two approved type portable fire extinguishers.
(i) One landing gear position indicator or equivalent facility.
(j) One first-aid kit.
(k) One magnetic compass.
(l) (1) In passenger service, such fire or smoke detecting and fire extinguishing equipment as is necessary for compliance with § 61.31 (b) and (c).
(2) In cargo service, one fixed fire extinguisher in each engine compartment.
(m) One or more storage batteries of sufficient capacity to operate all radio and electrical equipment.
(n) Two of the following units of radio equipment:
(1) One transmitter for two-way communication;
(2) One receiver for two-way communication;
(3) One radio range receiver.
(o) If such aircraft is a multiengine aircraft it may be operated with any one of the units of equipment in items (c), (e), or (f) above inoperative: *Provided*, That in the case of item (e) a cylinder temperature gauge in serviceable condition is installed on the same engine on which the inoperative oil temperature gauge is installed.

[Amdt. 51, 5 F. R. 1839, as amended by Amdt. 61-2, 11 F. R. 11355, Amdt. 61-4, 14 F. R. 2199]

§ 61.210 *Visual-contact night operation.*
(a) All equipment required for visual-contact day operation.
(b) Forward position lights and continuous white tail light.
(c) Two landing lights.
(d) Two 3-minute landing flares.
(e) One set of instrument lights.
(f) One electrical generator sufficient to operate all electrical and radio equipment.

[Amdt. 51, 5 F. R. 1839 as amended by Amdt. 61-5, 8 F. R. 3282]

§ 61.211 *Instrument or over-the-top day operation.* (a) All equipment required for visual-contact day operation.
(b) A fuel quantity indicator to show the amount of fuel in each of at least two fuel tanks.
(c) One additional air-speed indicator.
(d) An electrically heated pitot tube for each air-speed indicator.
(e) One rate of climb indicator.
(f) One gyroscopic rate-of-turn indicator combined with a bank indicator.
(g) One artificial horizon indicator.
(h) One directional gyrocompass.
(i) Two sensitive type altimeters.
(j) One outside air temperature gauge with indicating dial in cockpit.
(k) One clock with sweep second hand.
(l) One vacuum gauge installed in lines leading to the rate-of-turn and artificial horizon indicators and the directional gyrocompass.
(m) One carburetor ice indicator if the de-icing equipment requires manual manipulation.
(n) All of the radio equipment required by this chapter for instrument category of operation.
(o) One spare set of fuses.

[Amdt. 51, 5 F. R. 1839, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.212 *Instrument or over-the-top night operation.* (a) All equipment required for visual-contact night and instrument or over-the-top day operation.

[Amdt. 51, 5 F. R. 1839]

§ 61.213 *Operating limitations upon airplanes certificated under transport category requirements.* (a) When operating in scheduled passenger transportation any airplane certificated in accordance with the provisions of Part 4b, Subpart B (in the regulations issued on or after November 9, 1945), or of § 4a.737–T (in the regulations issued prior to November 9, 1945), the provisions of §§ 61.214–61.218 shall apply unless deviations therefrom are specifically authorized by the Administrator when he finds that, due to a peculiarity of a specific case, such application is unnecessary for safety.
(b) In determining compliance with these provisions, the data obtained in testing the airplane for type certification may be applied, by interpolation or by computation of the effects of changes in specific variables, to conditions differing from those for which specific tests are made, where such interpolations or computations will give results substantially equalling in accuracy the results of a direct test.

[Amdt. 61-20, 7 F. R. 989, as amended by Amdt. 61-12, 11 F. R. 5997, Amdt. 61-4, 14 F. R. 2199]

§ 61.214 *General limitations.* (a) The airplane shall not be operated from any field at an altitude outside of the altitude range for which maximum take-off weights have been determined and set forth in the airplane operating manual and shall not be dispatched to a field of intended destination, or have any field specified as an alternate, which is at an altitude outside the range for which maximum landing weights have been determined and set forth in the airplane operating manual.
(b) The weight of the airplane at take-off shall not exceed the certificated maximum take-off weight for the altitude of the field from which the take-off is to be made.
(c) The weight at take-off shall be such that, allowing for the consumption of the amount of fuel and oil which would normally be consumed in flight to the intended destination, the weight on arrival at the destination will not exceed the certificated maximum landing weight for the altitude of the field of intended destination.

[Amdt. 61-20, 7 F. R. 990, as amended by Amdt. 61-12, 11 F. R. 5997]

§ 61.215 *Take-off limitations to provide for engine failure.* Take-offs shall be made only from such fields in such directions and under such weight limitations that the following conditions are fulfilled as shown by the performance data determined under § 4b.91 or § 4a.747-T of this subchapter and set forth in the airplane operating manual.

(a) From any point on the take-off up to the time of attaining the critical-engine-failure speed set forth in the airplane operating manual, it shall be possible to bring the airplane to a safe stop within the landing area, as shown by the accelerate-and-stop distance data.

(b) If the critical engine should fail at any instant after the airplane attains the critical-engine-failure speed, it shall be possible to proceed with the take-off, and attain a height of 50 feet, as indicated by the take-off path data, before passing over the end of the take-off area. Thereafter it shall be possible to clear all obstacles either by at least 50 feet vertically, as shown by the take-off path data, or by at least 200 feet horizontally within the airport boundaries and 300 feet horizontally after passing beyond such boundaries. In determining the allowable deviation of the flight path in order to avoid obstacles, it shall be assumed that the airplane is not banked before reaching a height of 50 feet, as shown by the take-off path data, and that the maximum bank thereafter does not exceed 15°.

(c) In applying requirements (a) and (b), correction shall be made for any gradient of the take-off surface. Take-off data based on still air may be corrected to allow for the effect of a favorable wind which is equal to not more than 50 percent of the component along the take-off runway due to the reported wind condition.

[Amdt. 61-20, 7 F. R. 990 as amended by Amdt. 61-12, 11 F. R. 5997, Amdt. 61-12, 12 F. R. 6656, 6923]

§ 61.216 *Landing distance limitations.* (a) Airplanes shall be dispatched only under such conditions that it would be possible, as shown by the still air landing data, obtained in § 4b.111 of this subchapter or § 4a.750-T of this subchapter and set forth in the airplane operating manual, at a weight corresponding to the maximum weight expected to exist at the time of arrival at the field of intended destination, and under standard air conditions for the altitude of such field, to bring the airplane to rest, from a point 50 feet directly above the intersection of the obstruction clearance line (as defined in § 61.218) and the landing surface, within a total distance not in excess of 60 percent of the effective length (as defined in § 61.218) of the landing area most suitable for landing in still air.

(b) For every possible condition of wind velocity and direction and the corresponding landing direction required at the field of intended destination by the ground handling characteristics of the airplane category involved, the ratio of landing distance to effective length of landing area shall not be greater than that as specified in (a), after allowing for the effect on the landing path and roll of not more than 50 percent of the favorable wind component due to a particular wind condition.

(c) If requirement (a) can be met, but requirement (b) cannot be fully met, at a field of intended destination, a flight to such field may be dispatched under the following or more conservative conditions:

(1) At least one suitable alternate field shall be designated in the flight plan, at which requirements (a) and (b) of this section, as modified by § 61.217, and the requirements of §§ 61.203 and 61.204 are met.

(2) If requirement (b) cannot be met for the wind conditions existing at the time of arrival, the airplane shall proceed to the alternate.

[Amdt. 61-20, 7 F. R. 990, as amended by Amdt. 61-12, 11 F. R. 5997, Amdt. 61-4, 14 F. R. 2199]

§ 61.217 *Landing distance at alternate fields.* The conditions of § 61.216 shall apply with respect to alternate fields specified in the flight plan, except that in the case of alternate fields the landing distance as defined in that section shall not exceed 70 percent of the effective length of the landing area.

[Amdt. 61-20, 7 F. R. 990]

§ 61.218 *Definition of effective length of landing area.* The effective length of the landing area shall be the distance from the point where the obstruction clearance line, as defined below, intersects the landing surface to the far end of the landing area.

The obstruction clearance line is a line drawn tangent to or clearing all obstructions showing in a profile of the approach area, as defined below. The obstruction clearance line is further limited by having a slope to the horizontal of 1:20, as it approaches the landing area.

The approach area, as used in this section, shall be an area symmetrical about a center line coinciding with and prolonging the center line of the runway, except that where there is a multiplicity of parallel runways, or a large area continuously available for landing, the center line of the approach area shall coincide with the most probable landing path for instrument approaches. The approach area shall be considered as extending longitudinally from the landing area out to the most remote obstacle touched by the obstruction clearance line, assuming the center line of the approach area in plan view to be straight for at least 1,500 feet from the intersection of the obstruction clearance line with the landing surface, and thereafter continuing in a path consistent with the instrument approach procedures for the runway in question, or where such procedures are not specified, consistent with turns of at least 4,000 feet radius; and as extending laterally to a distance of 200 feet on either side of its center line at the point of intersection of the obstruction clearance line with the landing surface, with this distance increasing uniformly to 500 feet on either side of the center line of the area at a longitudinal distance of 1,500 feet from the intersection of the obstruction clearance line with the landing surface, and maintaining a distance of 500 feet from the center line thereafter.

[Amdt. 61-20, 7 F. R. 990, as amended by Amdt. 61-1, 11 F. R. 10650]

EN ROUTE LIMITATIONS

§ 61.219 *All airplanes; all engines operating.* Airplanes shall be dispatched only at such take-off weights that, in proceeding along the intended track with the weight of the airplane progressively reduced by the anticipated consumption of fuel and oil, the rate of climb with all engines operating (as set forth in the airplane operating manual), shall be, in feet per minute, 6 V_{s_0} at an altitude at least 1,000 feet above the elevation of the highest ground or obstruction within 10 miles of either side of the intended track; except that this requirement need not apply to airplanes certificated under the performance requirements of Part 4a of this subchapter.

[Amdt. 61-12, 11 F. R. 5997]

§ 61.220 *All airplanes; one engine inoperative.* Airplanes shall be dispatched only at such take-off weights that in proceeding along the intended track with the weight of the airplane progressively reduced by the anticipated consumption of fuel and oil, the rate of climb with one engine inoperative (as set forth in the airplane operating manual), shall be, in feet per minute, 0.02 $V_{s_0}^2$ for airplanes having maximum take-off weights up to 40,000 pounds, increasing linearly to 0.04 $V_{s_0}^2$ at 60,000 pounds, and 0.04 $V_{s_0}^2$ for maximum take-off weights above 60,000 pounds at an altitude at least 1,000 feet above the elevation of the highest ground or obstruction within 10 miles of either side of the intended track; except that for airplanes certificated under the performance requirements of Part 4a of this subchapter; the above rate-of-climb value may be 0.02 $V_{s_0}^2$ irrespective of maximum take-off weight.

[Amdt. 61-12, 11 F. R. 5997]

§ 61.221 *Airplanes with four or more engines; two engines inoperative.* If from any point along the track flown, more than 90 minutes at "all-engines-operating" cruising speed is required to reach an available landing area where the provisions of § 61.216 as modified by § 61.217 can be met at the airplane weight estimated to exist upon arrival there, an aircraft with four or more engines shall not be dispatched over such track unless its weight is such as to permit a rate of climb with two engines inoperative (as set forth in the airplane operating manual), in feet per minute, of 0.01 $V_{s_0}^2$ at an altitude of at least 1,000 feet above the elevation of the highest ground or obstruction within 10 miles on either side of the intended track to the landing area; or at 5,000 feet, whichever is higher; except that this requirement need not apply to airplanes certificated under the performance requirements of Part 4a of this subchapter. This specified rate of climb shall correspond to the airplane's weight attained at the moment of failure of the second engine (assumed to occur 90 minutes from time of departure), or to the weight which may be attained by dumping fuel at the moment of failure of the second engine: *Provided*, That sufficient fuel is retained aboard the airplane to reach a point 1,000 feet directly above the landing area.

[Amdt. 61-12, 11 F. R. 5997]

§ 61.222 *Special air navigation facilities*. Where special air navigation facilities provide for reliable and accurate identification of high ground or obstruction extending for less than 20 miles along the track, the lateral distance of 10 miles specified in §§ 61.219 through 61.221 may be reduced to 5 miles.

[Amdt. 61-12, 11 F. R. 5997]

FLIGHT PREPARATION AND TAKE-OFF RULES

§ 61.231 *Radio ground check*. Before departure from the originating terminal on any scheduled air carrier operation, at least one check shall be made by the pilot of the radio system to be used in flight.

§ 61.232 *Radio check after take-off*. When a trailing antenna is used, a precautionary radio check to determine possible loss of such antenna shall be made as soon as practicable after take-off.

§ 61.233 *Control tests*. The pilot shall test the flight controls to the full limit of travel immediately prior to the take-off run.

[Amdt. 61-2, 5 F. R. 11603]

§ 61.234 *View of traffic*. Immediately prior to take-off, the pilot shall maneuver the aircraft to a position from which he can observe incoming and outgoing aircraft.

§ 61.235 *Engine tests*. Before the take-off run, the aircraft engine or engines shall be individually tested at full throttle, except that supercharged engines shall be tested at run-up r. p. m. at the manifold pressure specified by the operator for the particular conditions involved. The engine temperatures (including oil, carburetor, and head temperatures) shall be normal and each magneto shall be individually tested.

(a) No person other than a certificated airman may run-up the engine or engines of an air carrier aircraft while such engines are installed in an air carrier aircraft.

(b) Engine run-ups shall be conducted in such a manner as to minimize the possibility of loose gravel, cinders, and like material contacting the propeller blades and aircraft control, lift, and stabilizing surfaces.

§ 61.236 *Instrument tests*. Before the take-off run, as many as possible of the aircraft flight instruments, and particularly all pressure gauges and gyroscopic flight instruments, shall be tested by the pilot to determine that they are all functioning properly.

§ 61.237 *Take-off restrictions*. No pilot shall take off any air carrier aircraft if, in his opinion, the aircraft is not airworthy. No pilot shall take off any air carrier aircraft at any time when an engine is not functioning properly.

§ 61.238 *Runway utilization*. The take-off shall be started from a point which makes available the greatest length of runway, considering the direction of the wind.

§ 61.239 *Restricted-vision take-offs*. If a method of take-off under conditions of restricted vision (including conditions of ground fog) is specified in the air carrier operating certificate it shall be strictly followed.

[CAR, May 31, 1938, as amended by Amdts. 61-21 through 61-31, 7 F. R. 1415]

§ 61.240 *Pilots at controls*. Neither pilot shall leave the controls during ascent of the aircraft immediately following take-off.

§ 61.241 *Ice and snow*. No scheduled air carrier aircraft shall take off when the wings or tail surfaces of such aircraft have a coating of ice or snow.

FLIGHT COURSE AND EN ROUTE RULES

§ 61.251 *Weather minimums*—(a) *Point cleared to*. No scheduled air carrier aircraft dispatched in accordance with §§ 61.201–61.204 shall continue toward the point cleared to unless weather conditions at such point remain at or above the minimums specified in the air carrier operating certificate for such airport: *Provided, however*, That such aircraft may be redispatched en route in accordance with § 61.203 (b) if the weather conditions at the point cleared to drop below the minimums specified in the air carrier operating certificate.

(b) *Alternate airports*. No scheduled air carrier aircraft shall continue toward the point cleared to unless the weather minimums at required alternate airports (§ 61.201) specified in the clearance remain, throughout the flight, at or above the minimums specified in the air carrier operating certificate for such airport when used as an alternate: *Provided, however*, That the clearance may be amended en route by the substitution of another alternate airport within the fuel range of the aircraft as outlined in § 61.183 (b) with weather conditions at or above the minimums specified in the air carrier operating certificate for such airport when used as an alternate.

[CAR, May 31, 1938, as amended by Amdts. 61-21 through 61-31, 7 F. R. 1415, Amdt. 61-36, 7 F. R. 6632]

§ 61.252 *Deviation from route*. No scheduled air carrier aircraft shall deviate from its authorized route, except when operating in accordance with traffic control instructions issued by a control tower or control center or when circumstances render such deviation necessary as a safety measure. In the latter case any deviation of more than 25 miles from the authorized route shall be explained by the pilot in a written report to the Administrator of Civil Aeronautics. Such report shall be made within 7 days after the completion of the flight.

CROSS REFERENCE: For special regulation permitting noncompliance with this section in the case of flights of scheduled air carriers at certain altitudes, see Regulation, Serial No. SR-331, appearing as a note preceding the text of Part 40.

[Amdt. 61-11, 11 F. R. 5646]

§ 61.253 *Dispatcher emergency decisions*. In an emergency situation, arising during the course of the flight, which requires immediate decision and action on the part of the dispatcher, and that is known to him, the aircraft dispatcher shall notify and advise the pilot as to such situation. Further, the dispatcher shall determine from the pilot what final decision has been made by such pilot and shall cause the same to be entered in the station radio log.

§ 61.254 *Reporting icing conditions*. When a pilot reports an icing condition in accordance with § 61.292, the pertinent information including time, altitude, location, type and extent of the icing conditions encountered shall immediately be relayed to the nearest U. S. Weather Bureau airway station and to the appropriate general supervising and forecasting district headquarters of the U. S. Weather Bureau.

FLIGHT ALTITUDE RULES

§ 61.261 *Flight altitude rules*. Except during take-off and landing, the flight altitude rules prescribed in paragraphs (a) and (b) of this section, in addition to the applicable provisions of § 60.17, shall govern air carrier operations: *Provided*, That other altitudes may be established by the Administrator for any route or portion thereof where he finds, after considering the character of the terrain being traversed, the quality and quantity of meteorological service, the navigational facilities available, and other flight conditions, that the safe conduct of flight permits or requires such other altitudes.

(a) *Day VFR passenger operations*. No aircraft engaged in passenger operations shall be flown at an altitude less than 1,000 feet above the surface or less than 1,000 feet from any mountain, hill, or other obstruction to flight.

(b) *Night VFR or IFR operations*. No aircraft shall be flown at an altitude less than 1,000 feet above the highest obstacle located within a horizontal distance of 5 miles from the center of the course intended to be flown or, in mountainous terrain designated by the Administrator, 2,000 feet above the highest obstacle located within a horizontal distance of 5 miles from the center of the course intended to be flown: *Provided*, That in VFR operations at night in such mountainous areas aircraft may be flown over a lighted civil airway at a minimum altitude of 1,000 feet above such obstacle.

[Amdt. 61-13, 13 F. R. 589]

§ 61.262 *Maximum altitude of flight operations*. No scheduled air carrier aircraft shall be operated at altitudes above 17,000 feet above sea level unless specifically permitted by the terms of the air carrier operating certificate issued to the air carrier. A competent cabin attendant to care for passengers shall be provided on all air carrier flights carrying passengers operating for any period of time above 12,000 feet above sea level.

[Amdt. 120, 6 F. R. 3099, as amended by Admts. 61-21 through 61-31, 7 F. R. 1415]

§ 61.263 *Oxygen apparatus and its use*. No air carrier aircraft shall be operated in scheduled air transportation at an altitude exceeding 10,000 feet above sea level continuously for more than 30 minutes, or at an altitude exceeding 12,000 feet above sea level for any length of time, unless such aircraft is equipped with an effective oxygen apparatus and an adequate supply of oxygen available for the convenient use of the operating crew, and proper use is made of such apparatus.

[Amdt. 94, 6 F. R. 784]

INSTRUMENT APPROACH RULES

§ 61.271 *Altitude maintenance on initial approach.* When making an initial approach to a radio range station, on instruments or on top of overcast or clouds, an aircraft in scheduled air carrier operation shall not descend below the pertinent minimum altitude for initial approach specified in the air carrier operating certificate for such station, until arrival over the radio range station has been definitely proved by the method outlined in the appropriate instrument approach procedures of the air carrier operating certificate.

[CAR, May 31, 1938, as amended by Amdts. 61-21 through 61-31, 7 F. R. 1415]

§ 61.272 *Letting-down-through procedure.* When instrument authority is authorized standard instrument approach procedure shall be established by the operator for each radio range station used or to be used for letting-down-through, and approved by the Administrator and included in the air carrier operating certificate. The letting-down-through methods, procedures and minimums specified shall be strictly adhered to.

[CAR, May 31, 1938, as amended by Amdts. 61-21 through 61-31, 7 F. R. 1415]

§ 61.273 *Approach and landing limitations.* No instrument approach procedure shall be executed or landing made at an airport when the latest U. S. Weather Bureau weather report for that airport indicates the ceiling or visibility to be less than that prescribed by the Administrator for landing at such airport.

[Amdt. 61-3, 12 F. R. 345]

§ 61.273-1 *Standard instrument approach procedures (CAA rules which apply to § 61.273).* See Part 609 of this title.

[Supp. 3, 13 F. R. 1423. Correction noted at 14 F. R. 38]

LANDING RULES

§ 61.281 *Pilots at controls.* The pilots shall remain at their controls during the final approach and landing.

§ 61.282 *Restricted-vision landing.* The method of landing under conditions of restricted vision, when authorized, will be specified in the air carrier operating certificate, and shall be strictly adhered to.

[CAR, May 31, 1938, as amended by Amdts. 61-21 through 61-31, 7 F. R. 1415]

§ 61.283 *Provisional weight.* No aircraft, the specification for which lists a provisional weight, shall be landed at a weight in excess of standard, except in accordance with the provisions of § 61.310.

§ 61.284 *Fuel dumping.* No fuel shall be dumped in effecting a landing except in accordance with § 61.310, and then only if the pilot deems it safer than landing at a weight in excess of standard.

FLIGHT INTERRUPTION RULES

§ 61.291 *Weather interruption.* If any hazardous flight condition is encountered en route, the pilot shall broadcast information as to the course of action which he is taking and as to his reasons therefor.

§ 61.292 *Icing conditions.* No air carrier shall dispatch or operate aircraft in air transportation through any known or probable icing condition unless the aircraft is equipped for de-icing wings, propellers, and for such other parts of the aircraft as the Administrator may prescribe to assure safety of the flight under the particular conditions to be encountered. When an icing condition is encountered in flight the pilot shall, if possible, immediately notify his radio ground station of such fact and the company shall immediately transmit such information to the nearest office of the United States Weather Bureau in accordance with § 61.254.

[Amdt. 61-3, 8 F. R. 830]

§ 61.294 *Mechanical interruptions.* In the event of any mechanical failure or interruption (including failure of engine, flight instrument, radio, or other essential component of the aircraft) which may involve the safety of the flight, the pilot shall proceed to and land at the nearest place where a safe landing can be effected.

CROSS REFERENCE: For general pilot authorization in emergency situations, see § 61.310.

§ 61.295 *Communications failure.* In the event of inability to maintain two-way communication with the appropriate communications station or in the event that the pilot does not receive radio signals sufficient to permit him to maintain instrument flight to any point cleared to or otherwise specified in the approved flight plan, one of the following procedures shall be observed:

(a) *Contact flight.* The aircraft may proceed: *Provided,* That the flight may be made in accordance with contact flight rules as provided for in § 60.2 of this subchapter.

(b) *Landing.* Landing may be made at the nearest suitable airport at which favorable weather conditions exist.

(c) *Emergency procedure.* In the event weather conditions do not permit the procedures provided for in paragraphs (a) or (b) of this section, the pilot shall proceed according to his approved flight plan, including any amending instructions issued and acknowledged en route, with particular attention to maintaining his last acknowledged assigned altitude until the approach time last authorized for him, after which landing may be made. Normal traffic will resume as soon as the aircraft has landed or been accounted for, but, in any event, in not more than 30 minutes after the approach time last authorized for the aircraft.

[CAR May 31, 1938, as amended by Amdt. 102, 6 F. R. 1159, Amdt. 61-4, 8 F. R. 2006, and Amdt. 61-5, 10 F. R. 10165]

GENERAL PILOT RULES

§ 61.301 *Command of flight.* The pilot in command shall be in command during the flight of the aircraft.

[CAR, May 31, 1938, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.302 *Remaining at controls.* The pilots shall remain at their posts while the aircraft is in flight and shall not leave the pilot compartment except when it is necessary in attending to their regular duties or when replaced by a person authorized in § 61.303. When a copilot is required to attend passengers, he shall not, unless the pilot in command deems it necessary, leave the pilot compartment until the aircraft has ascended to its cruising altitude, or during the final stages of an approach for a landing.

[CAR, May 31, 1938, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.303 *Manipulation of controls.* No person, other than a pilot in command or copilot, shall manipulate the controls of an air carrier aircraft while in scheduled flight: *Provided,* That at the discretion of the pilot in command, such restriction shall not apply to authorized inspectors of the Administrator or to properly qualified company personnel or to properly qualified personnel of other air carriers.

[Amdt. 51, 5 F. R. 1839, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.304 *Pilot compartment.* (a) No person except a member of the operating crew, an air carrier inspector of the Administrator of Civil Aeronautics, or a duly authorized representative of the Civil Aeronautics Board shall be admitted to the pilot compartment.

(b) No person shall occupy a seat in the pilots' compartment or the companionway thereto unless such seat is securely attached to the structure of the aircraft and is provided with a safety belt which shall be kept fastened by the occupant throughout his occupancy of such seat.

(c) Unless a seat is also available for his use in the passenger compartment, no person shall be admitted to the pilot compartment during scheduled flight except:

(1) A member of the flight crew;

(2) A person engaged during flight in the checking of pilots' operations for the Federal Government or for the air carrier;

(3) Flight supervisory personnel of the air carrier concerned who are certificated pilots;

(4) Pilots in command or copilots of the air carrier concerned; or pilots in command or copilots of another scheduled air carrier who have been authorized by the air carrier concerned and the Administrator to make the trips over the route being flown for the purpose of route qualification or familiarization;

(5) Certificated aircraft dispatchers of the air carrier concerned or certificated aircraft dispatchers of another air carrier who have been authorized by the air carrier concerned and the Adminis-

trator to make the trips over the route being flown for the purpose of establishing or maintaining dispatcher route qualification; or

(6) Certificated mechanics of the air carrier concerned, in the performance of duty;

(7) Pilot trainees in the employ of the air carrier. This provision shall terminate at the end of the war.

(d) Any air carrier inspector of the Administrator of Civil Aeronautics or a duly authorized representative of the Civil Aeronautics Board shall be admitted to the pilot compartment of an air carrier aircraft at any time while in the performance of his official duty.

[Amdt. 103, 6 F. R. 1334, as amended by Amdt. 61-32, 7 F. R. 1664, Amdt. 61-2, 8 F. R. 830, Amdt. 61-7, 11 F. R. 5595, Amdt. 61-6, 12 F. R. 3171, Amdt. 61-4, 14 F. R. 2199]

§ 61.305 *Time of reporting for duty.* The pilot in command of any scheduled flight and the copilot shall report to the operations office of the operator in sufficient time prior to the start of any scheduled flight to study and familiarize themselves with weather conditions on the route to be flown and for the plan of flight to be executed for the proposed schedule.

§ 61.306 *Local airport rules and interline agreements.* Pilots shall at all times comply with accepted safety agreements or practices, including current inter-airline agreements and local airport traffic rules, as approved by the Administrator.

§ 61.307 *Maneuvers.* All aircraft maneuvers not necessary to the safe and orderly progress of the flight shall be avoided.

§ 61.308 *Maps and flight equipment.* It shall be the responsibility of the pilot in command before any scheduled flight is started to have in his possession in the cockpit proper flight and navigational facility maps, including instrument approach procedures when instrument flight is authorized, and such other flight equipment as may be necessary to properly conduct the particular flight proposed.

§ 61.309 *Flashlights.* It shall be the responsibility of the pilot in command to see that two satisfactory flashlights in good working order are provided in the aircraft and accessible to both pilots.

§ 61.310 *Emergency decisions.* The pilot in command is authorized, in emergency situations which require immediate decision and action, to resolve upon a course of action which is required by the factors and information available to him. He may, in such situations, deviate from prescribed methods, procedures, or minimums to the extent required by considerations of safety. When such emergency authority is exercised, the pilot shall, to the extent possible, keep the proper control station fully informed regarding the progress of the flight. He shall submit a written report of any such deviation to his operations manager. The operations manager shall furnish a copy of such report, with his comments, promptly to the Administrator.

[CAR, May 31, 1938, as amended by Amdt. 61-4, 14 F. R. 2199]

MISCELLANEOUS RULES

§ 61.321 *Distribution of notices.* The operator shall set up some provisions for the prompt transmission of all information pertaining to changes and irregularities of all navigational aids and facilities over his entire system. In addition where inter-air-line agreements, airway traffic control regulations, and local airport traffic rules, etc., have been provided and adopted, on any portion of the route or routes, prompt notice and appropriate instructions shall be given to all personnel concerned.

§ 61.322 *Air carrier aircraft proving period.* (a) All air carrier aircraft of a new type shall have at least 100 hours of proving tests in the hands of an air carrier, under the supervision of an authorized representative of the Administrator, before authority for carrying passengers may be issued. At least 50 hours of such tests shall be in scheduled air carrier operation and include at least 10 hours of night operation.

(b) In the case of major changes on aircraft previously proved, or the use of the same aircraft on a different operation, 50 hours of proving tests similar to that outlined in the preceding paragraph may be required, at least 25 hours of which shall be in scheduled operation.

(c) During the tests specified in paragraphs (a) and (b) of this section, passengers other than those essential to the tests are prohibited. Mail, express, and cargo may be carried, at the discretion of the Administrator.

[CAR, May 31, 1938, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.322-1 *Aircraft proving tests (CAA rules which apply to § 61.322)*—(a) *Purpose.* The purpose of aircraft proving tests is to determine the air carrier's ability to conduct the proposed operation in compliance with applicable provisions of the regulations in this subchapter and in accordance with the minimum safety requirements of the Civil Aeronautics Administration.

(b) *Application.* At least 15 days prior to the scheduling of aircraft proving tests, officials of the air carrier shall submit to the Civil Aeronautics Administration office handling its operations specifications, a written request for the assignment of Civil Aeronautics Administration personnel to observe the tests. The request must be accompanied by an original application and copies of pertinent proposed amendments to the operations specifications, and must include sufficient data pertaining to the aircraft to satisfy the Administrator that the air carrier is prepared for the aircraft proving tests. This will allow sufficient time for making any necessary additions or corrections, thus preventing delays or misunderstandings.

(c) *Conduct.* After the air carrier has made all the necessary preparations to conduct the aircraft proving tests, duly designated representatives of the Civil Aeronautics Administration will be assigned to observe them. Such portions of the aircraft proving tests as may be conducted under conditions of scheduled operation, shall be undertaken exactly as the operator intends to operate in scheduled air transportation when carrying passengers, property, or mail, or any combination thereof. Air carrier personnel assigned to conduct the aircraft proving tests shall be regular crew members who, it is anticipated, will be assigned to the aircraft.

(d) *Conclusion.* On completion of the aircraft proving tests, a reasonable period of time will be required in order that the information gained during the tests can be compiled by the field office and submitted, with recommendations regarding approval, to appropriate supervisory personnel of the Civil Aeronautics Administration.

[Supp. 2, 13 F. R. 3460. Corrections noted at 14 F. R. 38]

CROSS REFERENCE: For statements of policy by the Administrator of Civil Aeronautics regarding § 61.322 Air carrier aircraft proving period, see Part 910 of this title.

§ 61.323 *Smoking rules.* The operator may permit smoking in scheduled air carrier aircraft except in berths of sleeper planes and during refueling: *Provided,* (a) The aircraft carries a copilot or cabin attendant, who shall notify passengers when and where smoking is prohibited.

(b) Sufficient ash containers of a suitable type are provided.

[CAR, May 31, 1938, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.324 *No smoking signs.* A prominent "No Smoking" sign shall be displayed in berths.

§ 61.325 *Smoking in pilot compartment.* When the operator permits smoking in the pilot compartment, suitable ash containers for the members of crew shall be provided. In no event shall smoking be permitted during take-offs, landing, and refueling.

§ 61.326 *Radio rules.* The following rules will govern the use and operation of radio facilities by an air carrier.

(a) Radio facilities, exclusive of the emergency equipment in the aircraft, shall be ready for immediate use at all times when the aircraft is in flight, except as may otherwise be provided for in § 61.208.

(b) The radio communications system required by this subchapter shall at all times be operated in strict accordance with the rules and regulations provided therefor by the Federal Communications Commission.

CROSS REFERENCE: For the regulations of the Federal Communications Commission governing aviation radio services, see Telecommunication, 47 CFR Part 9.

(c) Where a communication channel serves point-to-point contacts in addition to ground to plane it is required that priority of the circuit be given to plane to ground and ground to plane communication. Where in the opinion of the Administrator the volume of point-to-point traffic is so heavy as to interfere with the primary purpose of the circuit, i. e., plane to ground and ground to plane contacts, the Administrator may require that all other traffic be removed from this circuit.

§ 61.327 *Fuel dumping.* In circumstances other than those in connection with the effecting of a landing, fuel shall not be dumped except in accordance with § 61.310, and then only if the pilot deems it safer than any other procedure.

§ 61.328 *Marking emergency exits.* Emergency exits of aircraft carrying passengers shall be clearly marked as such in letters not less than three-fourths of an inch high with luminous paint, such markings to be located either on or immediately adjacent to the pertinent exit and readily visible to passengers. Location and method of operation of the handles shall be marked with luminous paint.

[Amdt. 61-13, 8 F. R. 14602]

OPERATIONS MANUAL

§ 61.331 *Necessity.* Each operator of a scheduled air carrier shall prepare and maintain an operations manual for the use and guidance of the air carrier flight and ground personnel. If desired by the operator, such manual may be broken down into two or more parts, on a divisional basis, but the manual for each division shall be complete as pertains to such division.

§ 61.332 *Contents.* Each operations manual, including a divisional manual, shall contain:

(a) A copy of that portion of the air carrier operating certificate pertaining to en route operations and airport specifications.

(b) A copy of all interline traffic agreements affecting the particular operation involved; and

(c) Any other data or information which the operator desires to include for the efficiency or safety of the operation.

[CAR, May 31, 1938, as amended by Amdts. 61-21 through 61-31, 7 F. R. 1415]

§ 61.333 *Form.* The operations manual shall be loose-leaf in form, and each page therein shall be numbered and dated to show the currency of all material contained therein. All copies of such manual shall at all times be kept up to date.

§ 61.334 *Delivery of copies.* A copy of the operations manual shall be furnished to at least the following persons:

(a) The Administrator of Civil Aeronautics;

(b) The Chief of the Air Carrier Service, Civil Aeronautics Administration;

(c) Each air carrier inspector of the Administrator of Civil Aeronautics in charge of inspection on any portion of the route, including any division thereof;

(d) Each air carrier pilot in command;

(e) Each air carrier copilot;

(f) Each person authorized for dispatching duty;

(g) Each air carrier aircraft radio operator; and at

(h) Each air carrier terminal and scheduled intermediate stop.

[CAR, May 31, 1938, as amended by Amdt. 61-4, 14 F. R. 2199]

§ 61.334-1 *Copies of operations manual (CAA rules which apply to § 61.334).* The copy of the operations manual for the Administrator of Civil Aeronautics shall be delivered to the Director, Flight Operations Service, A-280, Civil Aeronautics Administration, Department of Commerce, Washington 25, D. C., and the copy of the operations manual for the Chief of the Air Carrier Service, Civil Aeronautics Administration, shall be delivered to the Chief, Scheduled Air Carrier Division of the region in which headquarters of the air carrier is located.

[Supp. 4, 13 F. R. 4252. Correction noted at 14 F. R. 38]

§ 61.335 *Record of copies.* Each air carrier shall keep a complete record of all persons to whom copies of its operations manual have been furnished.

§ 61.336 *Changes.* The following rules will govern changes made in the operations manual:

(a) Any change issuing from the Administrator pertaining to that portion of the air carrier operating certificate covering en route operations and airport specifications shall be promptly incorporated in the operations manual and a copy thereof sent, in the form of a new page of such manual, to each person required to hold a copy of the manual. Each amended page of the manual shall be properly dated.

(b) Upon receipt of such new page or pages, the recipient shall insert the current information in the manual.

(c) Any data not issuing from the Administrator may be changed by the operator, without approval of the Administrator, providing such change is not inconsistent with any Federal regulation or the air carrier operating certificate. Notice of any such change shall be given promptly in accordance with the provisions of paragraph (a) of this section.

[CAR, May 31, 1938, as amended by Amdts. 61-21 through 61-31, 7 F. R. 1415]

REPORTS

§ 61.341 *General.* Each scheduled domestic air carrier shall furnish the Administrator such reports as may be required by him.

§ 61.341-1 *Mechanical hazard and difficulty reports (CAA rules which apply to § 61.341)*—(a) *Daily report of mechanical hazards.* (1) Whenever a failure, malfunctioning, or other defect is detected in flight or on the ground in an aircraft or aircraft component which may reasonably be expected by the air carrier to cause a serious hazard in the operation of any aircraft, notice thereof shall be transmitted through the air carrier's principal maintenance base to the Civil Aeronautics Administration maintenance agent-in-charge assigned to the air carrier.

NOTE: Failures, malfunctionings, or other defects required to be reported under these rules comprise generally the following basic items:

(1) Fire hazards.

(2) Structural hazards.

(3) Serious system or component malfunctioning or failure,

(4) Unsafe procedures or conditions, and

(5) Defects in design or quality of parts and materials found installed on aircraft or intended for such installation.

(2) Such daily reports shall be required only where mechanical hazards have been detected; shall cover the 24-hour period from midnight to midnight of each day; and shall be transmitted to the assigned maintenance agent of the Civil Aeronautics Administration before noon of the following working day, except that reports for Fridays, Saturdays, and Sund ys may be submitted not later than noo of the following Mondays.

(3) Su h reports may be transmitted in a ma ner and on a form convenient to the carrier's system of communications a procedures.

NOTE: hhenever practicable, the following guide fo each aircraft category should be used by ne air carrier in the preparation of the ly reports:

(1) egory, NC identification of aircraft, ine and trip number.

(2) ergency procedure effected (unschedu d landing, dumped fuel, etc.).

(3) ture of condition (fire, structural failure etc.).

(4) dentification of part and system involve .

(5) pparent cause of trouble (wear, cracks, design, personnel error, etc.).

(6) Disposition (repaired, replaced, aircraft grounded, etc.).

(7) Brief narrative summary to supply any other pertinent data required for more complete identification, determination of seriousness, etc.

(4) The daily reports should not be withheld pending presentation of all specific details pertaining to such items of information. As soon as the additional information is obtained it may be submitted as a supplement to the report.

(5) The rules requiring daily reports of mechanical hazards will become effective upon publication in the FEDERAL REGISTER.

[CAR, May 31, 1938, as amended by Amdt. 61-4, 14 F. R. 2199]

(b) *Monthly report of mechanical difficulties.* (1) As soon as practicable after the expiration of each calendar month, each air carrier shall submit in triplicate on a form prescribed by, or other form acceptable to, the Administrator, such information with respect to the mechanical defects, malfunctionings, and failures which occurred to the aircraft and components operated by the air carrier during the preceding calendar month, as may be necessary to determine the mechanical reliability of such aircraft and components. The detailed information upon which such reports are based shall be made available for review by the assigned maintenance agent of the Civil Aeronautics Administration, or an authorized representative of the Civil Aeronautics Board.

NOTE: Sample guides for this form may be obtained from authorized representatives of the Administrator.

(2) The foregoing monthly reporting procedure shall become effective beginning with the calendar month of October 1948.

[Supp. 6, 13 F. R. 5808, 5858, 5877]

§ 61.342 *Monthly report.* A monthly operations report shall be submitted to the Administrator, on and in accordance with a form supplied for the purpose, not later than the 20th day of the next succeeding month.

§ 61.343 *Mechanical interruption.* A mechanical interruption report shall be submitted to the Administrator, on and in accordance with a form supplied for the purpose, through the air carrier maintenance inspector of the Administrator assigned to such operation, as soon as possible but not later than 10 days after such mechanical interruption occurs. Any block-to-block instrument or equipment mechanical failure, in whole or in part, shall be reported as above.

§ 61.344 *Weather interruption.* An air carrier shall maintain and make readily available to inspectors of the Administrator or Board for not less than [illegible] year from the date of the flight the records pertaining to any flight of aircraft engaged in air transportation which, because of unfavorable weather conditions, was interrupted by either:

(a) Failure to land at the point or points to which the flight was cleared;

(b) A landing at a point other than that to which the flight was specificially cleared;

(c) Landing at points cleared to other than in the progressive order of landing specified in the flight clearance; or

(d) A re-clearance by radio during flight.

Such records shall include at least the flight plan, flight log, company clearance form, and weather reports upon which the clearance was based.

[Amdt. 52, 5 F. R. 1949]

§ 61.345 *Mechanical record.* The records of the air carrier covering mechanical trouble shall be made available upon request to any authorized representative of the Administrator or Board.

[Amdt. 75, 5 F. R. 3947]

§ 61.346 *Irregularity report.* All airmen, including flight and ground personnel, shall immediately report any irregularity or hazard which exists on or adjacent to any civil airway, and which in their opinion, makes for unsafe operation of aircraft in flight. Such report shall be made to the air carrier operations manager, who shall verify its accuracy to the best of his ability. If the report is justified, notice of the irregularity or hazard shall at once be given to the Administrator.

PART 62—NOTICE AND REPORTS OF AIRCRAFT ACCIDENTS AND MISSING AIRCRAFT

AUTHORITY: §§ 62.0 to 62.47 issued under secs. 205 (a), 702, 52 stat. 984, 1013; 49 U. S. C., 425 (a), 582.

SOURCE: §§ 62.0 to 62.47 appear at 14 F. R. 1516.

§ 62.0 *Applicability of this part.* The provisions of this part establish requirements for the notification and reporting of accidents involving civil aircraft in the United States, and aircraft of United States registry wherever they occur, and further establish requirements for the notification of overdue aircraft.

§ 62.1 *Definitions.* (a) As used in this part the words listed below shall be defined as follows:

(1) *Aircraft accident.* An aircraft accident is an accident which occurs during the starting or warming up of an engine or engines, or operation of an aircraft, which results in serious or fatal injury to one or more persons or in substantial damage to any aircraft. Whenever fatal or serious injury results from contact with a rotating propeller which is installed on an aircraft, it shall be considered an aircraft accident. A collision of two or more aircraft is considered one aircraft accident. Aircraft accidents are divided into two classifications: (i) Aircraft accidents incident to flight and (ii) aircraft accidents not incident to flight.

(2) *Accident incident to flight.* An aircraft accident incident to flight is an accident which occurs between the time an engine or engines are started for the purpose of commencing flight until the aircraft comes to rest with all engines stopped for complete or partial deplaning or unloading. It excludes death or injuries to persons on board which result from illness, altercations, falling, stumbling, etc., or during enplaning or deplaning and other occurrences not directly attributable to normal flight operation.

(3) *Accident not incident to flight.* An aircraft accident not incident to flight is an aircraft accident other than one defined in subparagraph (2) of this paragraph as incident to flight.

(4) *Operator.* An operator of aircraft shall include the owner, lessee, and any other person who causes or authorizes the operation of the aircraft.

(5) *Fatal injury.* Fatal injury is an injury which results in death within 30 days.

(6) *Serious injury.* Serious injury is an injury which requires hospitalization and medical treatment for a period of five or more days, or results in a fracture of any bone (except simple fractures of fingers, toes, or nose), lacerations which cause severe hemorrhages, or involve muscles, injury to any internal organ, or second or third degree burns or any burns involving more than 5% of the body surface, provided that the injury does not result in death within 30 days.

(7) *Minor injury.* Minor injury is any injury which does not result in death within 30 days and is not a serious injury.

(8) *Substantial damage.* Substantial damage is damage which necessitates major overhaul of the aircraft or the replacement of or extensive repairs to any major component or combination of components of the aircraft.

(9) *Minor damage.* Minor damage shall include damage which is easily repairable such as scraped wing tips, bent fairing or cowling, small punctured holes in the skin or fabric, dented skin or trailing edge, or damage to tires, engine accessories, brakes, or propeller blades.

SUBPART A—AIR CARRIER REQUIREMENTS

NOTICE OF ACCIDENT

§ 62.5 *Notice of aircraft accident and occurrences.* Immediate notice shall be given of any accident involving air carrier aircraft of United States registry wherever it occurs. Immediate notice will be made of any occurrence of fire involving any of the components or systems aboard the aircraft when incident to flight, regardless of the extent of injury to occupants or damage to the aircraft.

§ 62.6 *Responsibility for giving notice.* In accidents or occurrences involving air carrier aircraft of United States registry, the operator thereof shall be responsible for giving notice as provided in § 62.5.

§ 62.7 *To whom notice is directed.* The notice shall be directed to the Civil Aeronautics Board through its nearest office or through the nearest Civil Aeronautics Administration communications station or agent who upon receipt shall transmit the information to the nearest Civil Aeronautics Board office. The notice shall be sent by the most expeditious means of communication available.

§ 62.8 *Information to be given in notice.* The notice shall include the following information concerning the accident, if available: Location, date, time of day, number of persons involved, injuries to each, aircraft identification including registration number, aircraft make and model, names of crew members, operator, and briefly the nature or circumstances surrounding the accident.

REPORT OF ACCIDENTS

§ 62.10 *Report of aircraft accidents.* A written report shall be made of every aircraft accident incident to flight involving air carrier aircraft of United

States registry wherever it may occur. A written report will not be required on any occurrence involving minor damage, or minor injury, or of any aircraft accident not incident to flight, unless the operator has been requested to make such a report by an authorized representative of the Civil Aeronautics Board or the Civil Aeronautics Administration.

§ 62.11 *Responsibility for making report.* The operator of the aircraft involved in the accident shall be responsible for making the written report required by § 62.10. The report shall be made as soon as practicable and good cause shown in writing for any delay over ten days. Each member of the crew involved in the accident, if not physically incapacitated at the time of the submission of the report, shall attach thereto a signed statement setting forth the facts, conditions, and circumstances pertinent to the accident. If incapacitated, a statement shall be submitted as soon as physically possible.

§ 62.12 *Form of report and contents.* The report shall be made in duplicate on an accident report form furnished by the Civil Aeronautics Board and shall contain all available information required therein.

§ 62.13 *To whom the report is directed.* The original and one copy of the report shall be mailed or delivered to the office or representative of the Civil Aeronautics Board nearest the headquarters of the air carrier involved, or delivered to a Civil Aeronautics Administration agent who will immediately transmit the original copy of the report with the originals of any attachments directly to the appropriate office of the Civil Aeronautics Board.

PRESERVATION OF WRECKAGE AND RECORDS

§ 62.14 *Preservation of aircraft wreckage and records.* Aircraft, parts, and records thereof involved in or pertaining to an accident of which notice must be given under the provisions of § 62.5 shall be preserved for the Board by the operator.[1] Wreckage of aircraft involved in accidents not requiring notification under § 62.5 need not be preserved, unless specifically ordered by an authorized representative of the Civil Aeronautics Board or of the Administrator.

§ 62.15 *Prohibition against removing or disturbing wreckage and records.* Aircraft, parts, or records thereof involved in or pertaining to an accident of which notice must be given under the provisions of § 62.5 shall not be disturbed or removed, unless specific permission is granted by an authorized representative of the Civil Aeronautics Board, except where necessary (a) to give assistance to persons injured or trapped therein, (b) to protect such wreckage from further serious damage, or (c) to protect the public from injury.

[1] Where accidents occur outside of the United States, its territories, or possessions, the air carrier shall only be responsible for taking such measures for preserving aircraft wreckage or records as may legally be taken in the place where the accident occurs.

§ 62.16 *Recording of original position and condition of wreckage.* Whenever wreckage is removed in accordance with the provisions of § 62.15, prior to the removal, sketches or photographs shall be made of the original position and condition of the wreckage, and marks on the ground, and any pertinent data which cannot be effectively photographed shall be recorded, unless the resultant delay would endanger the lives of persons injured, or trapped, or unless the essential interests of public safety can be protected only by immediate movement. In any event, movement of the wreckage shall be so accomplished as to entail the minimum possible disturbance thereof, and it shall be preserved in accordance with the provisions of § 62.14.

§ 62.17 *Release of wreckage.* Aircraft, parts, or records thereof involved in or pertaining to an accident of which notice must be given under the provisions of § 62.5 shall not be released for repair, salvage, disposal, or any other purpose until permission is granted by an authorized representative of the Civil Aeronautics Board.

NOTICE OF OVERDUE AIRCRAFT

§ 62.21 *When notice is to be given.* When an aircraft is overdue and the operator is reasonably sure that it has been involved in an accident, the operator shall immediately notify the Civil Aeronautics Board in accordance with the provisions of §§ 62.6 through 62.8.

§ 62.22 *Contents of notice.* The notice shall include place, date and time of departure, destination, estimated time of arrival, aircraft identification including registration number, make and model, names of crew members and passengers, operator, and all other known pertinent information concerning the flight. In addition, it shall be the responsibility of the operator to furnish such records pertinent to the flight as may be requested by the Civil Aeronautics Board.

SUBPART B—REQUIREMENTS FOR CIVIL AIRCRAFT OTHER THAN AIR CARRIER AIRCRAFT

NOTICE OF ACCIDENT

§ 62.31 *Notice of aircraft accident and occurrences.* Immediate notice shall be given when any occurrence incident to flight, and involving civil aircraft in the United States, or within a territory or possession thereof, or civil aircraft of United States registry anywhere, (a) is known or believed to have resulted from structural failure of an aircraft, aircraft engine, or prepeller, (b) involves collision of two or more aircraft in the air, (c) involves fire on board an aircraft, or (d) results in serious or fatal injury to any person.[2]

§ 62.32 *Responsibility for giving notice.* In all civil aircraft accidents of which immediate notice must be given, the pilot, or pilots, or, if the pilots are incapacitated, the owner or operator shall be responsible for giving such notice.

[2] It will be noted that notice is required even though the damage to the aircraft is only minor in nature.

§ 62.33 *To whom notice is directed.* The notice must be directed to the Civil Aeronautics Board through its nearest office or through the nearest Civil Aeronautics Administration communications station or agent who upon receipt shall transmit the information to the nearest Civil Aeronautics Board office. The notice shall be sent by the most expeditious means of communication available.

§ 62.34 *Information to be given in notice.* The notice shall include the following information concerning the accident, if available: location, date, time of day, number of persons involved, injuries to each, aircraft identification including registration number, aircraft make and model, names of crew members, operator, and briefly the nature or circumstances surrounding the accident.

REPORT OF ACCIDENT

§ 62.36 *Report of aircraft accident.* A written report shall be made of every aircraft accident involving aircraft of United States registry wherever it may occur. A written report is not required on an occurrence involving minor injury or minor damage, unless the pilot, owner or operator has been requested to make a report by an authorized representative of the Civil Aeronautics Board or the Civil Aeronautics Administration.

§ 62.37 *Responsibility for making report.* The pilot, owner, or operator of the aircraft involved in the accident shall be responsible for making the written report required by § 62.36. The report shall be made as soon as possible and good cause shown in writing for any delay over seven days. If the operator is not the pilot, then each pilot involved in the accident, if not physically incapacitated at the time of the submission of the report, shall sign the report or attach thereto a signed statement setting forth the facts, conditions, and circumstances pertinent to the accident. When incapacitated at the time of the submission of the report, the pilot shall submit such a statement as soon as he is physically able to do so.

§ 62.38 *Form of report and contents.* The report shall be made in duplicate on an accident report form furnished by the Civil Aeronautics Board and shall contain all available information required therein.

§ 62.39 *To whom the report is directed.* The original and one copy of the report shall be mailed or delivered to the nearest office of the Civil Aeronautics Board or delivered to a Civil Aeronautics Administration agent who will immediately transmit the original copy of the report with the originals of any attachments directly to the appropriate office of the Civil Aeronautics Board.

PRESERVATION OF WRECKAGE AND RECORDS

§ 62.41 *Preservation of aircraft wreckage and records.* Aircraft, parts, and records thereof involved in or pertaining to an accident of which notice must be given under the provisions of § 62.31 shall be preserved for the Board by the pilot, owner, or operator.[3] Wreckage of aircraft involved in accidents not requiring notification under § 62.31 need not be preserved, unless specifically ordered by an authorized representative of the Civil Aeronautics Board or of the Administrator.

§ 62.42 *Prohibition against removing or disturbing wreckage and records.* Aircraft, parts, or records thereof involved in or pertaining to an accident of which notice must be given under the provisions of § 62.31 shall not be disturbed or removed, unless specific permission is granted by an authorized representative of the Civil Aeronautics Board, except where necessary (a) to give assistance to persons injured or trapped therein, (b) to protect such wreckage from further serious damage, or (c) to protect the public from injury.

§ 62.43 *Recording of original position and condition of wreckage.* Whenever wreckage is moved in accordance with the provisions of § 62.42, sketches or photographs of the original position and condition of the wreckage, marks on the ground, and any other pertinent data shall be made prior to the removal, unless the resultant delay would endanger the lives of persons injured, or trapped, or unless the essential interests of public safety can be protected only by immediate movement. In any event, movement of the wreckage shall be accomplished so as to entail the minimum possible disturbance thereof and shall be preserved in accordance with the provisions of § 62.41.

§ 62.44 *Release of wreckage.* Aircraft, parts, or records thereof involved in or pertaining to an accident of which notice must be given under the provisions of § 62.31 shall not be released for repair, salvage, disposal, or any other purpose until permission is granted by an authorized representative of the Civil Aeronautics Board.

NOTICE OF MISSING AIRCRAFT

§ 62.46 *Notice of missing aircraft.* When an aircraft is assumed to be missing and the operator or owner is reasonably sure that it has been involved in an accident, the operator or owner shall immediately notify the Civil Aeronautics Board in accordance with the provisions of §§ 62.32 through 62.34.

§ 62.47 *Contents of notice.* The notice shall include place, date and time of departure, destination, estimated time of arrival, aircraft identification including registration number, make and model, names of crew members and passengers, operator, owner, and all other known pertinent information concerning the flight. In addition, it shall be the responsibility of the owner or operator to furnish such records pertinent to the flight as may be requested by the Civil Aeronautics Board. If the aircraft is still missing upon the expiration of seven days, the reporting provisions of §§ 62.36 through 62.39 shall be complied with.

[3] Where accidents occur outside of the United States, its Territories, or possessions, the operator shall only be responsible for taking such measures for preserving aircraft wreckage or records as may legally be taken in the place where the accident occurs.

PART 97—RULES OF PRACTICE GOVERNING SAFETY CASES ARISING UNDER SECTIONS 602 AND 609 OF THE CIVIL AERONAUTICS ACT OF 1938, AS AMENDED, AND PETITIONS FOR WAIVERS OF CIVIL AIR REGULATIONS

NOTE: For proposal to revise this part and to redesignate it as Part 301, see 14 F. R. 2574.

AUTHORITY: §§ 97.1 to 97.24 issued sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 1001, 1002, 52 Stat. 1017, 1018; 49 U. S. C. 641, 642.

SOURCE: §§ 97.1 to 97.24, contained in Amendment 97-0, Civil Air Regulations, 11 F. R. 14257, 12 F. R. 64, except as noted following section affected.

§ 97.1 *Initiation of proceedings.* A proceeding may be initiated by the Administrator of Civil Aeronautics as plaintiff by filing a complaint with the Board. In any case where, under the provisions of the Civil Aeronautics Act of 1938, as amended, the circumstances, in the opinion of the Board, require action and no complaint has been filed by the Administrator of Civil Aeronautics, the Board may institute proceedings on its own initiative by the issuance of an order to show cause.

§ 97.2 *Complaint; order to show cause; allegations.* The complaint or order to show cause shall contain:

(a) A short plain statement of the grounds upon which the Board's legal authority and jurisdiction rests;

(b) A plain statement of the facts which the Administrator or the Board proposes to establish; and

(c) A statement of the action the Administrator requests of the Board, or which the Board proposes to take on its own initiative.

§ 97.3 *Filing of complaint or order to show cause.* An original and nine copies of the complaint or order to show cause, either in printed or typewritten form, shall be filed with the Docket Section of the Board.

§ 97.4 *Service.* When a complaint or order to show cause is filed the Safety Legal Division shall send a copy thereof by registered mail, return receipt requested, to the defendant, together with a copy of these rules of practice and a statement concerning hearing as provided in § 97.7. The complaint or order to show cause will be deemed served upon the defendant on the date specified on the postal return receipt.

§ 97.5 *Answer.* After service upon him of the complaint or order to show cause the defendant shall have ten days within which to answer in writing the allegations set forth therein. Such answer shall be deemed filed as of the date of mailing to the Civil Aeronautics Board properly addressed and postage prepaid. Failure to answer any of the allegations within the prescribed ten-day period shall be deemed an admission of the allegations not answered. Upon good cause shown, the examiner to whom the case is assigned or the Safety Legal Division may grant additional time within which to answer.

§ 97.6 *Motions to make more definite and certain.* Defendant may file with his answer a motion that the allegations in the complaint or order to show cause be made more definite and certain. Such motion shall point out the defects complained of and the details desired.

§ 97.7 *Request for or waiver of hearing.* An appropriate form for requesting or waiving a hearing shall be mailed to defendant with a copy of the complaint or order to show cause. Defendant shall have until the time for filing of his answer to the complaint or order to show cause to request a hearing. Failure to make such request within the prescribed time shall be deemed a waiver of defendant's right to a hearing. The defendant may at any time cancel his request for a hearing.

§ 97.8 *Notice of hearing.* When a hearing has been requested, the Safety Legal Division shall give the defendant adequate notice of the date and place where such hearing will be held; the nature thereof; the legal authority and jurisdiction under which the hearing is to be held; and the matters of fact and law asserted. In fixing the times and places for hearings due regard shall be had for the convenience and necessity of the parties and their representatives.

§ 97.9 *Amendment of pleadings.* Either party to the proceedings may amend his pleadings, as a matter of course, by serving a copy of such amended pleadings on the adverse party and by filing with the Board at any time more than 15 days prior to the date of hearing three copies of the amended pleadings. After that time, or in the event a hearing has been waived, amendment shall be allowed at the discretion of the examiner assigned to the case. In case of an amendment to any pleading, the examiner shall allow the party affected thereby a reasonable opportunity to reply thereto and to request a hearing thereon.

§ 97.10 *Withdrawal of complaint.* A complaint may be withdrawn by the Administrator of Civil Aeronautics, as plaintiff, at any time prior to the issuance of an initial decision in the proceeding as provided for in §§ 97.14 and 97.15, by filing with the Board an original and two copies of a formal Notice of Withdrawal of Complaint stating the reasons for such action, together with a signed statement that a copy thereof has been mailed to the defendant, and the proceeding shall thereupon be deemed terminated without further action of the Board.

[Amdt. 97-1, 12 F. R. 1509]

§ 97.11 *Appearances.* Any party to a proceeding may appear and be heard in person or by attorney. No register of attorneys who may practice before the Board is maintained and no application for admission to practice is required. Any attorney practicing or desiring to practice before the Board may, upon hearing and good cause shown, be suspended or prohibited from so practicing.

§ 97.12 *Subpoenas.* Subpoenas requiring the attendance of witnesses, or the production of evidence, at a designated place of hearing, shall be issued to any party to a proceeding upon proper application to an examiner duly designated by the Board for such purpose.

Such application shall be in writing and must show the general relevance and reasonable scope of the evidence sought. An application for the subpoena for the production of evidence must describe in detail the articles or documents desired.

§ 97.13 *Depositions.* After answer is filed by defendant the testimony of any person within the United States may be taken by deposition at the instance of either party to the proceedings. Such depositions shall be taken before any person having power to administer oaths who is designated by the Safety Legal Division or the examiner to whom the case is assigned, in accordance with the provisions of section 1004 of the Civil Aeronautics Act of 1938, as amended.

§ 97.14 *Submission without hearing or appearance.* Where a hearing has been waived by the defendant, the examiner, on the basis of the pleadings and the documentary evidence submitted to the Board by the parties, shall prepare the initial decision. The examiner shall serve a copy of this initial decision upon the defendant and his counsel, if any, and upon the plaintiff, by personal service or registered mail. The parties to the proceedings shall have ten days, or such other time as the examiner may specify, after the date of service of such initial decision within which to file exceptions and appeal to the Board. The date of service shall be the date shown upon which service was actually effected except where service is made by registered mail the date of service shall be the date shown on the postal return receipt. If no appeal to the Board is filed or action by the Board to review such decision is entered within the time allowed, such decision shall without further proceedings then become the decision of the Board.

§ 97.15 *Hearing cases; initial decision; exceptions; oral argument.* In any case in which a hearing has been requested, at the close of the hearing the examiner may render his initial decision orally or, if either party requests or the examiner desires the initial decision to be in writing, the examiner shall prepare and cause the same to be served upon the parties by registered mail or personal service as soon as possible. An appeal to the Board must be made in writing and shall clearly state the exceptions taken and the assignments of error upon which the appeal is predicated. A request for oral argument must also be in writing and shall clearly state any special reasons therefor. If no appeal to the Board is filed or action by the Board to review such decision is entered within the time allowed, such decision shall without further proceedings then become the decision of the Board.

§ 97.16 *Refusal of Administrator to issue airman certificates.* Any person whose application for the issuance or renewal of an airman certificate or rating has been denied may petition the Board for a review of the action of the Administrator. Upon request petitioner shall be granted a hearing which shall be conducted in accordance with the procedure set forth in § 97.15, or he may submit the matter for determination without a hearing in accordance with the procedure set forth in § 97.14.

§ 97.17 *Petition for waiver of Civil Air Regulations.* Any person adversely affected by the requirements of any regulation of this subchapter may petition the Board for a waiver of such requirements and the Board will, after a consideration of the matters presented in the petition, and as it may appear in the public interest, either grant or deny such petition in whole or in part. A public hearing will not be held on a petition for waiver of the regulations of this subchapter unless expressly so ordered by the Board.

§ 97.18 *Stay of order pending judicial review.* The filing of a petition for a judicial review of an order made under these rules as provided in section 1006 of the Civil Aeronautics Act of 1938, as amended, shall not operate to stay the effectiveness of the order unless specifically so ordered by the Board. The petitioner may request, and if good cause is shown therefor, the Board will stay the effectiveness of the order from which an appeal is being taken.

§ 97.19 *Petition for rehearing, reargument, reconsideration or modification of order.* (a) Either party to a proceeding may petition for rehearing, reargument, reconsideration or modification of any final order of the Board within fifteen days after the receipt thereof. Every such petition shall be in writing, filed with the Board and served by petitioner upon the adverse party and his attorneys of record. If the petition be to take further evidence, the nature and purpose of the new evidence to be adduced must be briefly stated and the reasons why such evidence was not presented at the time of the prior hearing must be stated. If the petition be for reargument, reconsideration or modification of the order, the matters claimed to have been erroneously decided must be specified and the alleged errors briefly stated.

(b) Replies to petitions filed pursuant to this section shall be filed and served upon petitioner and his attorneys of record within ten days after the receipt of the petition. Upon good cause shown the Safety Legal Division may extend the time for filing such replies.

(c) The filing of a petition to rehear or reargue a proceeding or to reconsider or modify an order, shall not operate to stay the effectiveness of the order, unless otherwise ordered by the Board.

§ 97.20 *Evidence*—(a) *Right to full and true disclosure of the facts.* Every party shall have the right to present his case or defense by oral or documentary evidence, to submit evidence in rebuttal, and to conduct such cross-examination as may be required for a full and true disclosure of the facts.

(b) *Burden of proof.* In general the proponent of any rule or order shall have the burden of proof thereof.

(c) *Admission and exclusion of evidence.* The trial examiner shall admit relevant, material, and competent evidence, but shall exclude irrelevant, immaterial, incompetent, or unduly repetitious evidence.

(d) *Order to be based on whole record.* No order shall be issued except upon consideration of the whole record or such portions as may be cited by any party and as supported by and in accordance with reliable, probative and substantial evidence.

(e) *Objections.* Objections to the evidence before a trial examiner shall be in short form; but written argument in support of such objections, specifying the grounds thereof, may be presented at the discretion of the trial examiner. The transcript shall not include argument or debate thereon except as ordered by the trial examiner. Rulings on such objections shall be a part of the transcript. An objection not urged in an appeal from the examiner's initial decision will be deemed to have been waived.

§ 97.21 *Trial examiners' authority.* Trial examiners shall have the authority, subject to the published rules of the Board and within its powers, as follows:

(a) To give notice concerning, and hold, hearings;

(b) To administer oaths and affirmations;

(c) To examine witnesses;

(d) To take or cause depositions to be taken whenever the ends of justice would be served thereby;

(e) To rule upon offers of proof and receive competent evidence;

(f) To regulate the course of the hearing;

(g) To hold conferences, before or during the hearing, for the settlement or simplification of issues, by consent of the parties;

(h) To dispose of procedural requests or similar matters;

(i) Within his discretion, or upon the direction of the Board, to certify any question to the Board for its consideration and disposition;

(j) To issue subpoenas as provided for in § 97.14.

(k) To make initial decisions;

(l) To take any other action authorized by these rules; and

(m) The trial examiner's authority in each case will terminate:

(1) When the time for appeal from the initial decision shall have expired,

(2) When he shall have withdrawn from the case upon considering himself disqualified, and

(3) Whenever the Board shall have determined that the trial examiner is disqualified, upon the filing in good faith of a timely and sufficient affidavit of bias or disqualification.

§ 97.22 *Submittals and decisions.* At any time during the process of hearing and appeal to the Board, the examiner shall give the parties to the proceeding adequate opportunity for the presentation of arguments in support of motions, objections, and exceptions. Prior to each initial decision, or decision upon a Board review thereof, the parties shall be afforded a reasonable opportunity to submit for consideration (a) proposed findings and conclusions, or (b) exceptions to the initial decisions of the trial examiners, and (c) supporting reasons for such exceptions or proposed findings or conclusions. The record shall show the ruling upon each such finding, conclusion, or exception presented.

§ 97.23 *Saving clause.* The repeal or amendment of any regulation of this subchapter shall not affect any pending proceeding or any proceeding thereafter commenced to alter, amend, modify, suspend, or revoke any certificate issued by the Administrator for causes arising or acts committed prior to said repeal or amendment, unless the act of repeal or amendment specifically so provides.

§ 97.24 *Applicable rules of Federal procedure.* In any situation not provided for or controlled by this part, the rules of civil procedure for the District Courts of the United States, wherever applicable, shall govern.

Subchapter B—Economic Regulations

PART 200—DEFINITIONS AND INSTRUCTIONS

Sec.
200.1 Board.
200.2 Act.
200.3 Section.
200.4 Rule, regulation, and order.
200.5 Other terms.
200.6 Terms defined by act.
200.7 Instructions.

AUTHORITY: §§ 200.1 to 200.7 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425.

SOURCE: §§ 200.1 to 200.7 appear at 14 F. R. 3524.

§ 200.1 *Board.* The term "Board" means the Civil Aeronautics Board.

§ 200.2 *Act.* The term "Act" means the Civil Aeronautics Act of 1938 as amended.

§ 200.3 *Section.* The term "section" refers to a section of the act or a section of the regulations in this chapter, as indicated by the context.

§ 200.4 *Rule, regulation, order.* The terms "rule", "regulation", and "order" refer to the rules, regulations, and orders prescribed by the Board pursuant to the act.

§ 200.5 *Other terms.* The terms "this section", "pursuant to this section", "in accordance with the provisions of this section", and words of similar import when used in this chapter refer to the section of this subchapter in which such terms appear.

§ 200.6 *Terms defined by act.* Unless otherwise specifically stated, other words and phrases have the meaning defined in the act.

§ 200.7 *Instructions.* The regulations of the Board may be cited by section numbers. For example, this regulation may be cited as § 200.7 of the "Economic Regulations." The sections contained in the Rules of Practice under title IV and sections 1002 (d) to (i) of the act, may also be cited by appropriate rule numbers. For example, section 10 may be cited as "rule 10 of the Rules of Practice." In each case in which a rule, regulation, order, or other document of the Board refers to a regulation or a rule of practice of the Board by means of the numbering system used prior to the adoption of section numbers, such reference shall be deemed to relate to the appropriate new section number of this subchapter.

Certificates of Public Convenience and Necessity

PART 201—APPLICATIONS FOR CERTIFICATES OF PUBLIC CONVENIENCE AND NECESSITY

Sec.
201.1 Formal requirements.
201.2 Amendments.
201.3 Incorporation by reference.
201.4 General provisions concerning contents.
201.5 Operations other than between fixed points.

AUTHORITY: §§ 201.1 to 201.5 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 401, 52 Stat. 987, 49 U. S. C. 481.

SOURCE: §§ 201.1 to 201.5 appear at 14 F. R. 3524.

§ 201.1 *Formal requirements.* Applications for certificates of public convenience and necessity or amendments thereof, shall meet the requirements set forth in Part 302 of this chapter as to (a) execution, number of copies, and service; (b) verification; and (c) formal specifications of papers. All pages of an application shall be consecutively numbered and the application shall clearly describe and identify each exhibit by a separate number or symbol. All exhibits shall be deemed to constitute a part of the application to which they are attached.

§ 201.2 *Amendments.* If, after receipt of any application, the Board shall request the applicant to supply it with additional information, such information shall be furnished in the form of an amendment to the original application. All amendments to applications shall be consecutively numbered and shall comply with the requirements of this part as to form, number of copies, verification, and other essential respects.

§ 201.3 *Incorporation by reference.* In general it is desirable that incorporation by reference shall be avoided. However, where two or more applications are filed by a single carrier, lengthy exhibits or other documents attached to one may be incorporated in the others by reference if that procedure will substantially reduce the cost to the applicant.

§ 201.4 *General provisions concerning contents.* (a) The statements contained in an application shall be restricted to significant and relevant facts. They shall be free from argumentation or from expressions of opinions, except such as may be required by this part.

(b) Requests for authority to engage in air transportation between points in the continental United States and requests for authority to engage in air transportation to or from any point outside the continental United States shall not be included in the same application. Similarly, requests for authority to engage in scheduled air transportation and requests for authority to engage in nonscheduled air transportation shall not be included in the same application.

(c) Each application shall give full and adequate information with respect to each of the items set forth in this paragraph. In addition, the application may contain such other information and data as the applicant shall deem necessary or appropriate in order to acquaint the Board fully with the particular circumstances of its case. Among other things, every such application shall contain the following information:

(1) The full name and address of the applicant, the nature of its organization (individual, partnership, corporation, etc.) and the name of the State under the laws of which it is organized.

(2) A statement that the applicant is a citizen of the United States as defined by section 1 (13) of the act. It is not required that the application shall contain all the evidence which the applicant is prepared to present at the hearing or otherwise in support of such statement, but the application shall at least indicate the nature and result of its investigations in that matter and the character of the evidence it will be prepared to present in support of citizenship.

(3) An adequate identification of each route for which a certificate is desired, specifying the type or types of service (mail, passengers, and property) to be rendered on each such route, and whether or not such services are to be rendered in scheduled operations. The identification of each route shall name every terminal and intermediate point to be included in the certificate for which application is made.

(4) A map (which may be attached as an exhibit) drawn approximately to scale showing all terminal and intermediate points to be served, giving the approximate mileages between all adjacent points, and the principal over-all distances.

(5) A statement as to the type of aircraft applicant proposes to use in the

new service and whether such aircraft is presently owned by the applicant.

(6) If applicant does not hold a certificate of public convenience and necessity authorizing air transportation, the name and type of business of any affiliate, subsidiary, or principal stockholder of applicant engaged in any form of transportation as a common carrier or engaged in any phase of aeronautical activity.

(7) If applicant does not hold a certificate of public convenience and necessity authorizing air transportation, a statement as to whether or not applicant is currently engaged in air transportation pursuant to the authority granted by Part 291 of this chapter.

(8) If the application shows, pursuant to subparagraph (7) of this paragraph that the applicant is currently engaged in air transportation pursuant to the authority granted by Part 291 of this chapter, a statement that all reports due under said part from the applicant have been filed with the Board and the date or dates thereof. No proceedings other than those necessary for amendment or dismissal shall be had on any application which fails to comply with this subparagraph or discloses failure by the applicant to file such a required report while default in filing such report continues.

§ 201.5 *Operations other than between fixed points.* An application for a certificate authorizing operations other than between fixed points, or not having terminal or intermediate points capable of precise description, need comply with the provisions of § 201.4 (c) (3) and (4) only to the extent that it shall clearly describe the authorization sought by the applicant.

PART 202—TERMS, CONDITIONS AND LIMITATIONS OF CERTIFICATES OF PUBLIC CONVENIENCE AND NECESSITY; INTERSTATE AND OVERSEAS AIR TRANSPORTATION

AUTHORITY: §§ 202.1 to 202.7 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 401, 52 Stat. 987, 49 U. S. C. 481.

SOURCE: §§ 202.1 to 202.7 appear at 14 F. R. 3525.

§ 202.1 *Applicability.* Unless a certificate or the order authorizing the issuance of such certificate shall otherwise provide, there shall be attached to the exercise of the privileges granted by each certificate authorizing an air carrier to engage in interstate or overseas air transportation pursuant to section 401 of the act such terms, conditions, and limitations as are set forth in this part, and as may from time to time be prescribed by the Board.

§ 202.2 *Nonstop authorization.* Subject to the provisions of section 405 (e) of the act, the holder of a certificate may inaugurate scheduled nonstop service between any two points not consecutively named in its certificate (if such certificate authorizes service between such points and does not prohibit nonstop service between them) upon the effective date of a schedule page, showing such nonstop service, filed with the Board in accordance with Part 231 of this chapter.

§ 202.3 *Airport authorization*—(a) *Airport notice.* If the holder of a certificate desires to serve regularly a point named in such certificate through the use of any airport not then regularly used by such holder, such holder shall file with the Board written notice of its intention so to do. Such notice shall be filed at least 30 days prior to inaugurating the use of such airport. Such notice shall be conspicuously entitled Airport Notice, shall clearly describe such airport and its location, and shall state the reasons the holder deems the use of such airport to be desirable. The use of such airport may be inaugurated 30 days after the filing of such notice, unless the Board notifies the holder within said 30-day period that it appears to the Board that such use may adversely affect the public interest, in which event such use shall not thereafter be inaugurated (except as may be expressly permitted by such notification) unless and until the Board finds, upon application filed by the holder, that the public interest would not be adversely affected by such use. The Board may permit the use of an airport at any time after the filing of the Airport Notice whenever the circumstances warrant such action. In no event shall the holder use the provisions of this paragraph as authority to receive passengers at one airport and discharge such passengers at any other airport serving the same point.

(b) *Service of notice.* A copy of each Airport Notice shall be served upon such persons as the Board may designate in a particular case, and shall be served upon the following persons in all cases:

(1) The Postmaster General, marked for the attention of the Second Assistant Postmaster General;

(2) Each scheduled air carrier which regularly renders service to or from the point intended to be served through the proposed airport;

(3) The chief executives of the city (or other political subdivision) and of the State, in which are located the currently used airport, the proposed airport, and the point to be served, respectively. (If there be a state commission or agency having jurisdiction of transportation by air, notice shall be served on such commission or agency rather than on the chief executive of the State.)

§ 202.4 *Service pattern change*—(a) *Applicability.* This section shall be applicable only to certificates which contain a condition requiring that each trip operated by the holder of the certificate between points named in the route or a segment thereof shall (subject to exceptions set forth in such certificate) serve each terminal and intermediate point.

(b) *Application for change in service pattern.* If at any time the holder of such a certificate desires to establish a service pattern omitting one or more of the points served or required to be served pursuant to such condition of the certificate, the holder shall make written application to the Board for approval thereof. Such application shall be conspicuously entitled Application for Change in Service Pattern, and shall set forth the facts relied upon to establish that the proposed service pattern is in the public interest and consistent with the holder's performance of a local air transportation service. The Board will grant such application to such extent, for such periods of time, and subject to such conditions as the Board deems proper and adequate, if it finds that such condition would prevent a proposed service pattern which is in the public interest and consistent with the holder's performance of a local air transportation service.

(c) *Service of application.* A copy of each Application for Change in Service Pattern shall be served upon such persons as the Board may designate in a particular case, and shall be served upon the following persons in all cases;

(1) The Postmaster General, marked for the attention of the Second Assistant Postmaster General;

(2) Each scheduled air carrier which regularly renders service to or from any point named on the route segment the service pattern of which the holder proposes to change;

(3) The chief executives of each point on such route segment and of each State in whch are situated the points on such route segment. (If there be a State commission or agency having jurisdiction of transportation by air, notice shall be served on such commission or agency rather than the chief executive of the State.)

§ 202.5 *Filing and service of notices and applications.* An original and nine copies of each Airport Notice or Application for Change in Service Pattern shall be filed with the Board, each setting forth the names and addresses of the persons required to be served and stating that service has previously been made on all such persons by personal service or by registered mail. In the case of registered mail, the date of mailing shall be considered the date of service. Each copy of a notice or application served pursuant to this part shall be accompanied by a letter of transmittal stating that such service is made pursuant to Part 202.

§ 202.6 *Provisions as to scheduled stops.* (a) With respect to a flight carrying any passengers in addition to the crew members, a scheduled stop at a point within the continental United States shall not be scheduled to exceed 45 minutes on any flight if the origination or termination of such flight at such point is prohibited by any restriction in the certificate.

(b) With respect to a flight carrying only property or mail in addition to the crew members, a scheduled stop at a point within the continental United States shall not be scheduled to exceed 2 hours on any flight if the origination or termination of such flight at such point is prohibited by any restriction in the certificate.

(c) A certificate containing a condition or restriction which has the effect of permitting the origination of a flight only at a certain point or points shall not be deemed to permit an increase in passenger or property-carrying capacity (by change of gage, substitution of equipment, addition of extra sections, or otherwise) on any such flight at any point other than a point at which the origination of such flight is authorized. A certificate containing a condition or restriction which has the effect of permitting the termination of a flight only at a certain point or points shall not be deemed to permit a decrease in passenger or property-carrying capacity on any such flight at any point other than a point at which the termination of such flight is authorized. With respect to a particular flight, a point shall not be deemed to be beyond another specified point within the meaning of such condition or restriction unless the holder serves such other specified point on such flight or omits service thereto pursuant to regulation or other specific authorization (such as authority to render nonstop service, or to suspend service to such point) of the Board.

§ 202.7 *Failure to comply.* It shall be a condition upon the holding of the certificate that any intentional contravention in fact by the holder of the provisions of Title IV of the act or of the orders, rules, or regulation issued thereunder, or of the terms, conditions, and limitations attached to the exercise of the privileges granted by the certificate, even though occurring without the territorial limits of the United States shall (except to the extent that such contravention in fact shall be necessitated by an obligation, duty, or liability imposed by a foreign country) be a failure to comply with the terms, conditions, and limitations of the certificate within the meaning of section 401 (h) of the act.

PART 203—TERMS, CONDITIONS AND LIMITATIONS OF CERTIFICATES OF PUBLIC CONVENIENCE AND NECESSITY; FOREIGN AIR TRANSPORTATION

AUTHORITY: §§ 203.1 to 203.8 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 401, 52 Stat. 987, 49 U. S. C. 481.

SOURCE: §§ 203.1 to 203.8 appear at 14 F. R. 3526.

§ 203.1 *General.* Unless the order authorizing the issuance of a particular certificate shall otherwise provide, there shall be attached to the exercise of the privileges granted by each certificate of public convenience and necessity authorizing an air carrier to engage in foreign air transportation issued pursuant to section 401 of the Civil Aeronautics Act of 1938, as amended, the terms, conditions, and limitations set forth in this part and such other terms, conditions, and limitations as may from time to time be prescribed by the Board and approved by the President of the United States.

§ 203.2 *Change in approved service plan.* If the holder of a certificate authorizing it to engage in foreign air transportation to a general area desires, as part of its approved service plan, to engage in foreign air transportation to a point in such area not then included in its approved service plan, or to cease to engage in foreign air transportation to a point in such area in its approved service plan, such holder shall make written application to the Board for approval thereof. Such application shall be conspicuously entitled Application for Change in Approved Service Plan—Foreign Air Transportation, shall clearly describe such point, its location, the segment of the approved service plan to which such point is to be added or from which it is to be removed, and shall set forth the facts relied upon to establish that the proposed change in the approved service plan is in the public interest. At the time such application is filed with the Board, a copy thereof shall be served by the holder upon such persons as the Board may require. After the filing of such application the holder may submit to the Board additional information in support of such application and shall file and serve copies of such additional information in the manner required in the case of such application. The Board will grant such application if it finds that such proposed change in the approved service plan is not inconsistent with the public interest.

§ 203.3 *Nonstop service.* (a) If at any time the holder of a certificate desires to render a scheduled nonstop service omitting one or more of the intermediate points served or to be served pursuant to the certificate, and if such nonstop service is not then regularly scheduled by such holder, such holder shall file with the Board written notice of its intention to inaugurate such service. Such notice shall be filed at least 20 days prior to inaugurating such service, shall be conspicuously entitled Notice of Nonstop Service in Foreign Air Transportation and shall fully describe such service. At the time such notice is filed with the Board a copy thereof shall be served by such holder upon such persons as the Board may require: *Provided*, That, subject to the provisions of section 405 (e) of the act, nonstop service may be inaugurated between any two points at any time without the filing of the notice herein prescribed, if, during the 12 months preceding such inauguration, nonstop service was regularly scheduled by such holder between such points during a period of at least 45 days.

(b) Such nonstop service may be inaugurated upon the expiration of 20 days after the filing of such notice unless:

(1) The Board notifies such holder within said 20-day period that it appears to the Board that such service may adversely affect the public interest, in which event such service shall not be inaugurated unless and until the Board finds upon application of the holder and after notice and public hearing that the public interest would not be adversely affected by such nonstop service; or

(2) Such service involves a schedule designated for the transportation of mail and the inauguration of such service on such day would be prohibited pursuant to the provisions of section 405 (e) of the act, in which event the inauguration of such service shall be subject also to said section. The Board may, subject to the provisions of section 405 (e) of the act, permit nonstop service to be inaugurated at any time after the filing of the Notice of Nonstop Service in Foreign Air Transportation herein prescribed whenever the circumstances warrant such action. The holder of a certificate issued pursuant to section 401 (e) (1) of the act, may, subject to the provisions of section 405 (e) of the act, continue to render any nonstop service regularly scheduled on the date of issuance of such certificate, although such nonstop service was not regularly scheduled by the holder on August 22, 1938, if the holder files a Notice of Nonstop Service in Foreign Air Transportation with respect to such service with the Board within 30 days after such date of issuance: *Provided*, That, if a direct, straight-line course between the points between which such service is operated appears to involve a substantial departure from the shortest course between such points as determined by the route described in the certificate, and if the Board shall, after notice and public hearing, instituted within 90 days after such date of issuance, find that the public interest would be adversely affected by such service on account of such substantial departure, such service shall thereupon be discontinued: *Provided further*, That, subject to the provisions of section 405 (e) of the act, nonstop service may be continued between any two points without the filing of the notice herein prescribed if, during the 12 months preceding the date of issuance of the certificate, nonstop service was regularly scheduled by the holder of the certificate between such points during a period of at least 45 days.

(c) Subject to the provisions of section 405 (e) of the act, nonstop service may be inaugurated between any two points at any time without the filing of the notice herein prescribed if, during the period from June 1, 1941, to May 31, 1942, inclusive, nonstop service was regularly scheduled by such holder between such points during a period of at least 10 days. This authorization shall remain in effect during the present war and thereafter until the Board shall by order declare the authorization terminated.

§ 203.4 *Requirements of foreign countries.* If at any time the holder of a certificate is required, in order to comply with any obligation, duty, or liability imposed by any foreign country (other than any obligation, duty, or liability arising out of a contract or other agreement entered into between an air carrier or any officer, or representative thereof, and any foreign country, if such contract or agreement shall have been disapproved by the Board as being contrary to the public interest):

(a) To inaugurate scheduled nonstop service omitting one or more of the intermediate points named in the certificate or included in the approved service plan and situated in one or more foreign countries; or

(b) To add a stop at a point not named in the certificate, or not included in the approved service plan, and situated in such foreign country; or

(c) To change the terminal point in such foreign country; such holder shall file with the Board written notice of such requirement. Such notice shall be filed within 20 days after the air carrier shall have been advised of such requirement; shall be conspicuously entitled Notice of Nonstop Service Required by Foreign Country, Notice of Additional Stop Required by Foreign Country, or Notice of Terminal Change Required by Foreign Country, as the case may be, and shall fully set forth the facts and circumstances relating to such requirement. At the time such notice is filed with the Board a copy thereof shall be served by the holder upon such persons as the Board may require. Such service may be inaugurated immediately upon the filing of such notice and may be continued unless and until the Board, after notice and public hearing, shall disapprove such service as being contrary to the public interest, or unless and until the Board shall find, after investigation, that such requirement of the foreign country is not in effect.

§ 203.5 *Airport notices.* (a) If the holder of a certificate desires to serve regularly a point through any airport not then regularly used by such holder, such holder shall file with the Board written notice of its intention so to do. Such notice shall be filed at least 30 days prior to inaugurating the use of such airport. Such notice shall be conspicuously entitled Airport Notice—Foreign Air Transportation, shall clearly describe such airport and its location, and shall state the reasons why the holder deems the use of such airport to be desirable. At the time such notice is filed with the Board a copy thereof shall be served by the holder upon such persons as the Board may require. Subject to the provisions of section 405 (e), the use of any such airport may be inaugurated upon the expiration of 30 days after the filing of such notice, unless within said 30-day period the Board shall serve upon the holder an order directing such holder to show cause why such use should not be disapproved: *Provided*, That, subject to the provisions of section 405 (e) of the act, the Board may permit the use of any airport prior to the expiration of such 30-day period whenever the circumstances warrant such action. Upon service of such order, such use shall not thereafter be inaugurated except as may be expressly permitted by such order unless and until the Board finds, after notice and public hearing, that the public interest would not be adversely affected by such use.

(b) If at any time the holder of a certificate is required, in order to comply with any obligation, duty, or liability imposed by any foreign country (other than any obligation, duty, or liability arising out of a contract or other agreement entered into between an air carrier, or any officer or representative thereof, and any foreign country, if such contract or agreement shall have been disapproved by the Board as being contrary to the public interest) to serve regularly a point or points in such foreign country through any airport not then regularly used by such holder, such holder shall file with the Board written notice of such requirement. Such notice shall be filed within 20 days after the air carrier shall have been advised of such requirement; shall be conspicuously entitled Airport Notice—Foreign Air Transportation—Change Required by Foreign Country; and shall fully set forth the facts and circumstances relating to such requirement. The use of such airport may be inaugurated immediately upon the filing of such notice and may be continued unless and until the Board, after notice and public hearing, shall disapprove the use of such airport as being contrary to the public interest, or unless and until the Board shall find, after investigation, that such requirement of the foreign country is not in effect.

§ 203.6 *Compliance.* It shall be a condition upon the holding of a certificate that any intentional contravention in fact by the holder of the terms of Title IV of the act or of the orders, rules, or regulations issued thereunder or of the terms, conditions, and limitations attached to the exercise of the privileges granted by the certificate, even though occurring without the territorial limits of the United States, shall, except to the extent that such contravention in fact shall be necessitated by an obligation, duty, or liability imposed by a foreign country, be a failure to comply with the terms, conditions, and limitations of the certificate within the meaning of section 401 (h) of the act.

§ 203.7 *Persons upon whom notice must be served.* A copy of each Application for Change in Approved Service Plan—Foreign Air Transportation, Notice of Nonstop Service in Foreign Air Transportation, Airport Notice—Foreign Air Transportation, Notice of Nonstop Service Required by Foreign Country, Notice of Additional Stop Required by Foreign Country, or Notice of Terminal Change Required by Foreign Country, as the case may be, filed with the Board pursuant to this part by the holder of a certificate of public convenience and necessity, shall be served upon the following:

(a) The Postmaster General, marked for the attention of the Second Assistant Postmaster General, if the holder's certificate authorizes the transportation of mail;

(b) The Secretary of State, marked for the attention of Chief, Aviation Division;

(c) In the case of an Application for Change in Approved Service Plan—Foreign Air Transportation, each scheduled air carrier which is authorized to serve the same general area in which is situated the point to which the holder, as part of its approved service plan, desires to engage, or to cease to engage, in foreign air transportation; and also each scheduled air carrier which is authorized to serve a general area contiguous to the general area wherein such point is situated;

(d) In the case of an Airport Notice—Foreign Air Transportation, each scheduled air carrier which regularly renders service to or from the point intended to be served through the proposed airport;

(e) In the case of a Notice of Nonstop Service in Foreign Air Transportation or Notice of Nonstop Service Required by Foreign Country, each scheduled air carrier which regularly renders service to or from any point (not located in the continental United States) named in such certificate or located in a general area the holder is authorized by such certificate to serve;

(f) In the case of a Notice of Additional Stop Required by Foreign Country or Notice of Terminal Change Required by Foreign Country, each scheduled air carrier which regularly renders service to or from such additional stop or new terminal point, as the case may be; and

(g) Such other persons as the Board may specially designate in a particular case.

§ 203.8 *Manner of filing and serving papers.* Service of a copy of an application or notice upon any person pursuant to this part may be made by personal service, or by registered mail addressed to such person. Whenever service is made by registered mail, the date of mailing shall be considered as the time when service is made. Each copy of a notice, served pursuant to this part shall be accompanied by a letter of transmittal stating that such service is being made pursuant to this part. An executed original and nine copies of each such notice shall be filed with the Board, and each such copy shall be accompanied by a statement to the effect that the air carrier has served a copy thereof upon each such person required to be served hereunder. Such statement shall include the names and addresses of the persons upon whom a copy of such notice was served.

PART 205—TEMPORARY SUSPENSION OF SERVICE AUTHORIZED BY CERTIFICATES OF PUBLIC CONVENIENCE AND NECESSITY

AUTHORITY: §§ 205.1 to 205.6 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 401, 52 Stat. 987, 49 U. S. C. 481.

SOURCE: §§ 205.1 to 205.6 appear at 14 F. R. 3527.

§ 205.1 *Service of notice.* Prior to or coincident with the filing of any application for temporary suspension of service to or from any point in any certificate of public convenience and necessity (hereinafter referred to as certificate) to or from any point included in an approved service plan designating points which may be served in general areas named in any certificate, the holder of such certificate, unless otherwise authorized by the Board, shall cause a notice of such filing together with a copy of the application to be served by personal service or registered mail upon:

(a) Each scheduled air carrier which regularly renders service to the point for which temporary suspension of service is sought;

(b) The chief executive of the city, town, or other unit of local government at any such point located in the United States or any Territory or possession thereof;

(c) The Secretary of State (marked for the attention of Chief, Aviation Division) if such point is not located in the United States or any Territory or possession thereof;

(d) The Postmaster General (marked for the attention of the Second Assistant Postmaster General) if the applicant's certificate authorizes the transportation of United States mail to or from such point;

(e) The manager or other individual having direct supervision over and responsibility for the management of the airport being used to serve such point at the time the application is filed.

§ 205.2 *Contents of notice.* Such notice shall state that it is being served pursuant to this part and shall indicate the date upon which the application will be or is being filed.

§ 205.3 *Form and contents of application.* The application shall be entitled Application for Order Authorizing Temporary Suspension of Service and in addition to the specific relief requested, shall contain a list of the persons upon whom notice of the filing thereof was or is being served, and facts relied upon to establish that the temporary suspension of service for which application is made is in the public interest. An executed original and nine copies of such application with a copy of the notice attached to each shall be filed with the Board.

§ 205.4 *Additional service of notice.* Action on the application may be withheld by the Board, in its discretion, pending proof of such additional service of notice by the applicant as the Board may direct.

§ 205.5 *Disposition.* The Board will grant such application if it finds that such temporary suspension of service is in the public interest. In case a certificate of public convenience and necessity contains a condition or limitation requiring service to a point on each trip or schedule operated on a route or a route segment by the holder of such certificate, an application based upon the fact that the air-carrier operating certificate of the holder does not authorize service to such point through any airport convenient thereto, with any type of aircraft then regularly being used, or proposed to be used, by the holder, will be granted only if the Board finds that such temporary suspension of service will not substantially change the character of the service for which the certificate of public convenience and necessity was granted, and is otherwise in the public interest. An order authorizing temporary suspension of service will be subject to revocation or amendment by the Board at any time.

§ 205.6 *Authorized suspensions of service.* (a) Unless otherwise ordered by the Board, the holder of a certificate shall not be required to file an application or obtain an order of the Board:

(1) For temporary suspension of service to a point named in such certificate, or included in the holder's approved service plan, during such time as the air carrier operating certificate of the holder does not authorize service to such point through the airport and with the type of aircraft last regularly used by the holder to serve such point;

(2) For temporary suspension of service to (i) a point named in a certificate issued pursuant to section 401 (d) or 401 (e) (2) of the act, but never regularly served by the holder after the date of issuance of the certificate, or (ii) a point included in the holder's approved service plan, but never regularly served by the holder after the date on which such point was included in such approved service plan during such time as the air carrier operating certificate of the holder does not authorize service to such point through any airport convenient thereto with any type of aircraft then regularly being used (or, if the holder is not operating, with any type of aircraft proposed to be used) by the holder for scheduled operations between other points served pursuant to such certificate: *Provided,* That the provisions of this subparagraph shall not apply to the temporary suspension of service to a point by the holder of a certificate of public convenience and necessity if such certificate contains a condition or limitation requiring service to such point on each trip or schedule operated on a route or a route segment by the holder of such certificate; or

(3) In the case of a point named in a certificate issued pursuant to section 401 (e) (1) of the act, for continued temporary suspension of service to such point if such service was suspended during the 30 days immediately preceding July 31, 1939.

(b) With respect to any such point the Board may by order at any time revoke or amend the authority conferred on the holder of a certificate by this section.

PART 206—CERTIFICATES OF PUBLIC CONVENIENCE AND NECESSITY; TEMPORARY INTERRUPTION OF SERVICE OR CHANGE OF ROUTE

§ 206.1 *Temporary interruption of service.* The temporary interruption of service to or from a point named in a certificate, or included in the holder's approved service plan, caused by adverse weather conditions, or by other conditions which the holder could not reasonably have been expected to foresee or control, shall not be deemed to constitute a temporary suspension of service within the meaning of Part 205 of this chapter or of the terms, conditions, or limitations of such certificate. (Sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interprets or applies sec. 401, 52 Stat. 987, 49 U. S. C. 481) [14 F. R. 3528]

Permits to Foreign Air Carriers

PART 211—APPLICATIONS FOR PERMITS TO FOREIGN AIR CARRIERS

AUTHORITY: §§ 211.1 to 211.5 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 402, 52 Stat. 991, 49 U. S. C. 482.

SOURCE: §§ 211.1 to 211.5 appear at 14 F. R. 3528.

§ 211.1 *Formal requirements.* Applications for permits to engage in foreign air transportation under the terms of section 402 of the act (hereinafter called foreign air carrier permits) shall meet the requirements set forth in § 302.3 of this chapter as to execution, number of copies, formal specifications of papers, and verifications. Such verifications shall be subscribed and sworn to before a notary public or other officer authorized to administer oaths in the jurisdiction in which such application is executed. Notwithstanding the laws of the country of applicant's citizenship, an application verified before a United States consular officer will be deemed to have met the requirements of this section. All pages of an application shall be consecutively numbered, and the application shall clearly describe and identify each exhibit by a separate number or symbol. All exhibits shall be deemed to constitute a part of the application to which they are attached.

§ 211.2 *Filing and service.* Applications for foreign air carrier permits shall be forwarded to the Board, through diplomatic channels, by the government of the applicant's country of citizenship, and shall be deemed to have been filed on the date such applications are actually received by the Board. Each applicant shall furnish such additional copies of its application, and shall make such service thereof upon such other persons as the Board may at any time require.

§ 211.3 *Amendments.* Any information which the Board may request of an applicant subsequent to receiving its application, or any information which the applicant deems appropriate to submit thereafter, shall be furnished in the form of an amendment to the original application. All amendments to applications shall be consecutively numbered and shall comply with the requirements of this part as to form, number of copies, verification, and in all other essential respects.

§ 211.4 *Incorporation by reference.* In general it is desirable that incorporation by reference shall be avoided. However, where two or more applications are filed by a single carrier, lengthy exhibits or other documents attached to one may be incorporated in the others by reference if that procedure will substantially reduce the cost to the applicant.

§ 211.5 *General provisions regarding contents.* The statements contained in an application shall be restricted to significant and relevant facts. They shall be free from argumentation or from expressions of opinion, except as such may be required by this part. Each application shall give full and adequate information with respect to each of the items set forth in this section. The application may contain such other information and data as the applicant shall deem necessary or appropriate in order to acquaint the Board fully with the particular circumstances of its case. Among other things, every such application shall contain the following information:

(a) The full name and address of the applicant, the nature of its organization (individual, partnership, corporation, etc.), and, if other than an individual, the name of the country under the laws of which it is organized and the statutory citation of such laws, if any. The citizenship of the applicant should be shown, as well as the percentage of direct and indirect beneficial and non-beneficial interest in applicant held by each government and aggregate of nationals of each government, other than the government of applicant's citizenship. If the applicant is governmentally owned or controlled in whole or in part, the extent of such governmental ownership or control should be shown.

(b) The name and official address of the competent air authority of applicant's country of citizenship having regulatory jurisdiction over applicant.

(c) An identification of the route or routes to be covered by the permit for which application is made, specifying the type or types of service (mail, passenger, and property) to be rendered on each such route, and whether or not such services are to be rendered in scheduled operations. The identification of each route shall name every terminal and intermediate point to be served by applicant in connection with the service for which a permit is sought.

(d) A map (which may be attached as an exhibit) drawn approximately to scale, showing all terminal and intermediate points, both in the United States and in all foreign countries to be served by applicant in connection with the service for which the permit is sought, giving the approximate air mileages between all adjacent points, and principal over-all distances.

(e) If the application is made pursuant to section 402 (c) of the act, it shall state that a permit for the services applied for was issued by the Secretary of Commerce under section 6 of the Air Commerce Act of 1926, as amended, giving the date of such issuance, and that such permit was in effect on May 14, 1938.

Tariffs of Air Carriers

PART 221—PREPARATION OF TARIFFS OF AIR CARRIERS

AUTHORITY: §§ 221.1 to 221.10 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply secs. 403 and 404, 52 Stat. 992, 993, 49 U. S. C. 483, 484.

SOURCE: §§ 221.1 to 221.10 appear at 14 F. R. 3529.

§ 221.1 *Definitions.* As used herein, unless the context otherwise requires:

(a) "Carrier" means any air carrier or any foreign air carrier subject to section 403 of the Civil Aeronautics Act of 1938.

(b) "Rates" includes "fares" and "charges."

(c) "Rules" includes "regulations" and "other governing provisions."

(d) "Tariff" means a publication containing rates applicable to the transportation of persons or property, and rules relating to or affecting such rates or transportation, whether such rates and rules are combined in one publication or are stated in separate publications. A "loose-leaf tariff" shall be deemed to consist of that combination of pages, whether original or revised, which is currently effective.

(e) "Local rate" means a rate that applies for service solely over the line or route of one carrier. "Local tariffs" are those which contain local rates or rules.

(f) "Joint rate" means a rate that applies for through service over the lines or routes of two or more carriers and that is made by arrangement between such carriers evidenced by concurrence or power of attorney as provided in Part 222 of this chapter. "Joint tariffs" are those which contain joint rates or rules.

(g) "Through rate" means the total rate from point of origin to destination, whether a local rate, a joint rate, or combination of separately published rates.

§ 221.2 *Form.* (a) All tariffs shall be in book, pamphlet, or loose-leaf form; supplements shall be in book or pamphlet form. The pages of a tariff or supplement shall be $8\frac{1}{2}$ by 11 inches (except that tariffs naming only rates for the transportation of property may be $9\frac{1}{2}$ by $11\frac{1}{2}$ inches) and shall be plainly printed, planographed, stereotyped, or prepared by other similar durable process on paper of good quality.

(b) The type used shall be of size not less than 8-point bold or full-face, except as provided in § 221.3 (a) and except that 6-point bold or full-face type may be used for explanation of reference marks and for column headings.

(c) A margin of not less than 1 inch, without any printing thereon, shall be allowed at the binding edge of each tariff or supplement thereto.

(d) Each carrier shall file tariffs under consecutive C. A. B. numbers. An agent shall file tariffs under his own C. A. B. numbers. Numbers shall run consecutively beginning with the next consecutive number in the existing series, or, if no tariffs shall have been issued previously, beginning with C. A. B. No. 1. Supplements to a tariff shall be numbered as provided in § 221.9 (a). If, for any reason a tariff or supplement is not numbered consecutively with the last filed publication in the same series, such tariffs or supplement must be accompanied by a memorandum explaining why consecutive numbers were not used. When a publication is rejected by the Board as unlawful, the number which it bears must not be again used. Such publication must not thereafter be referred to as canceled, amended, or otherwise, but a publication that is issued to take the place of such rejected publication must bear the notation, "Issued in lieu of C. A. B. No. ----, (or Supplement No. ----), (or ---- Revised page No. ----) rejected by the Board."

(e) Pages of loose-leaf tariffs must be consecutively numbered in the upper right-hand corner as "Original page 1," "Original page 2," etc. (see § 221.10 for numbering original pages issued subsequent to the filing of the original tariff); and must show at the top of the page the name of the publishing carrier or agent (see § 221.3 (a) (2)), the page number, and the C. A. B. number of the tariff, and at the bottom of the page the date of issue, the effective date, and the name, title, and business address of the issuing officer or agent. No alteration in writing or erasure shall be made on any tariff or supplement thereto.

§ 221.3 *Title page.* (a) The title page of every tariff or supplement shall consist of durable flexible paper of sufficient weight and strength to withstand hard usage and shall contain the following information in the order named:

(1) On the upper right-hand corner, the C. A. B. number in prominent bold-face type, which shall, on printed tariffs, be not less than 12 point. Immediately under this number there shall be shown the C. A. B. number or numbers of the tariff or tariffs canceled thereby.

(2) On the upper central portion the name of the issuing carrier or agent.

(b) Below the name of the carrier or agent:

(1) A statement indicating whether the tariff contains local or joint rates and rules, or a combination thereof;

(2) A brief but reasonably complete statement of the territory within which, or the points from and to, or between which, the rates or rules apply; and, where the application is indicated by states, the names of all states to or from which rates apply;

(3) The date on which the rates and rules will become effective, shown on the lower right-hand corner; and the date on which the publication is issued, on the lower left-hand corner;

(4) The name, title, and address of the person issuing the tariff, near the bottom of the title page.

(c) Every publication which contains rates or rules effective upon a date different from the general effective date of such publication shall show on its title page a notation in substantially the following form:

Effective ---------------- 19---- (except as otherwise provided herein) or (except as provided on page ----)

(d) On every tariff, supplement, or revised page in which all rates or rules are made effective on less than 30 days' notice under permission or order of the Civil Aeronautics Board, a notation in substantially the following form shall be shown:

Issued on ______ days' notice under (here describe and show date and number of the permission or order, etc.) issued by the Civil Aeronautics Board.

(e) A tariff containing only rates that are intended to apply for a limited period shall show on the title page an expiration date to coincide with the final date upon which such rates are applicable; when limited-period rates are published in the same tariff with permanent rates, such limited-period rates shall be properly reference-marked to indicate their expiration date.

§ 221.4 *Contents.* Tariffs shall contain in the order named:

(a) A table of contents showing the pages in the tariff where information concerning the general subjects covered by the tariff will be found, such subjects to be arranged in alphabetical order in the table, for example:

	Page
Abbreviations________________________	
Application of tariff_________________	
Baggage_____________________________	
Articles not accepted_________________	

If a tariff contains so small a volume of matter that its title page or its interior arrangement plainly discloses its contents, the table of contents may be omitted.

(b) The corporate names of participating carriers, alphabetically arranged, together with the number of the power of attorney or the concurrence of each under which the tariff is issued.

(c) A complete index, alphabetically arranged, of all articles upon which specific rates are named therein, making reference to each page where specific rates on each article are published. The index may also include a list of articles that will not be accepted for transportation. If all of the specific rates to each destination in a general property tariff or a combined passenger and property tariff is arranged in alphabetical order by articles, the index of articles may be omitted from that tariff.

(d) Alphabetical indexes of points of origin and destination from and to or between which rates are named in the tariff, unless such points are arranged in continuous alphabetical order in the tables naming the rates, and appropriate conspicuous notation of that fact appears on the title page of the tariff or supplement. Such indexes must show precisely and clearly (by use of point index or item or page numbers) the place or places in the tariff where the rates from or to each point may be found. Reissuance of pages containing such indexes will be required when the indexes do not permit ready and convenient location of all of the rates from or to each point. Separate indexes of points of origin and destination shall be provided, except that when all, or substantially all, of the rates named in the tariff apply in both directions between the points shown therein, the points of origin and destination may be combined in one index. The State or other governmental unit in which each point is located must be shown in each index.

(e) Explanation of reference marks, symbols, and abbreviations of technical terms used in the tariff, if not explained on the pages where such reference marks, symbols, and abbreviations are used.

(f) Such explanatory statements as may be necessary to remove all doubt as to the proper application of the rates and rules contained in the tariff. When rates are published for account of any carrier under authority of a limited concurrence or of a limited power of attorney, there shall be included in this section of the tariff such statement as is necessary to indicate clearly and definitely the extent to which the published rates apply for account of such carrier.

(g) General rules which govern the tariff, i. e., state conditions which in any way affect the rates named in the tariff, or the service under such rates. Each rule should be given a separate number. A rule affecting a particular rate must be specifically referred to in connection with such rate, except that rules affecting a limited number of the rates contained in the tariff, or applying for the account of only certain of the carriers for whom the rates are published, may be included in the explanatory statements authorized in paragraph (f) of this section. Reference to any rule published under the immediately preceding exception must be made in such manner as to leave no doubt concerning the application of the rates. A rate tariff may not refer to another rate tariff for rules.

(h) A statement of charges for excess baggage, sleeper service, and any other like services unless such charges are included in the statement of the rules governing such services.

(i) A statement of rates applicable for transportation of persons and property between the points named in the tariff as more particularly set forth in § 221.5.

(j) A clear and explicit statement of routes over which the published rates apply prepared in accordance with the provisions of § 221.6.

§ 221.5 *Statement of rates.* (a) If the same tariff contains rates for the transportation of passengers and rates for the transportation of property (other than the property of passengers carried as baggage), such rates shall be separately stated in distinct passenger and property sections of the tariff.

(b) All rates shall be clearly and explicitly stated (cents or dollars and cents) in terms of lawful money of the United States together with the name or proper designations of the places from and to which they apply; except that rates for transportation originating outside of the United States may be stated in terms of currencies other than lawful money of the United States. Rates stated in terms of foreign currency may be set forth in a separate tariff, or if included in the same tariff, must be set forth in a separate section which shall not precede the statement of rates in terms of lawful money of the United States. A rate stated in terms of lawful money of the United States shall not also be published in terms of a foreign currency. Tariffs may contain such information as may be required under the laws of any country in or to which an air carrier or foreign air carrier is authorized to operate.

(c) Rates for transportation by aircraft must be published for application from airport to airport, and must be stated separately from any charge made by the air carrier, or any subsidiary or affiliate thereof, for ground transportation to or from airports or for pick-up-and-delivery service; however, no separation of charges is necessary when the published rates include ground transportation at no additional charge. The tariff must definitely show any separate charge that is to be made by the air carrier, or any subsidiary or affiliate thereof, for ground transportation or pick-up-and-delivery service. Charges of others for such ground transportation or pick-up-and-delivery service may be shown in the tariff without being deemed to constitute a part thereof; but if shown must be plainly referenced to show that they are published for information only and not guaranteed by the air carrier.

(d) A tariff may provide rates for side trips from or to designated points by the addition of arbitraries to rates shown therein, but provisions for the addition of arbitraries shall be shown either in connection with the base rate or in a separate section which must specifically name the base point, and clearly and definitely state the manner in which such arbitraries shall be applied.

(e) When specific rates are established, the description of the article must be specific and the rates thereon may not be applied to analogous articles.

(f) When a carrier or carriers establish a local or joint rate for application over a designated route from point of origin to destination, such rate is the applicable rate of such carrier or carriers over that route, notwithstanding that it may be higher than the combination of rates between points on that route.

§ 221.6 *Statement of routes.* All tariffs containing joint passenger rates shall specify the route or routes over which each such rate applies, stated in such a manner that such routes may be definitely ascertained. Tariffs containing local passenger rates shall specify routes in the same manner if optional routing is available. Passenger tariffs must definitely provide that rates named therein apply only over routes specifically shown therein.

§ 221.7 *Rules.* (a) Rules relating to or affecting the application of rates may be published in a tariff other than the tariff naming the rates. The pertinent requirements of §§ 222.1, 221.2, 221.3 and 221.4 must be observed in the publication of rules tariffs.

(b) A rules tariff must provide that it governs only such rate tariffs as make specific reference thereto. Tariffs naming rates subject to a rules tariff must bear the following notation on the title page (or elsewhere as may be appropriate):

Governed, except as otherwise provided herein, by rules shown in (here insert name of issuing carrier or agent) Rules Tariff C. A. B. No. — supplements thereto, and succeeding issues thereof.

§ 221.8 *Amendments.* (a) Any change in or addition to a tariff shall be known as an amendment.

(b) A tariff may be amended at any time (1) by "reissuing" the tariff; i. e., by filing, posting and publishing an entirely new tariff which contains all of the unamended data in the previous tariff as well as a complete statement of the amended data, and which bears the next C. A. B. number in the series and directs the cancellation of the previous tariff; (2) by issuing a supplement (to a book or pamphlet tariff) constructed generally in the same manner, and arranged in the same order, as is the tariff (see § 221.9); or (3) by reprints of the pages of a loose-leaf tariff. (See § 221.10.)

(c) A rate or rule sought to be amended and the amendment thereto cannot be in effect at the same time. All amendments must be effected by specifically canceling the existing rate or rule, and publishing the new rate or rule which amends the existing rate or rule. Cancellation of the existing rate or rule must be made in the publication stating the new rate or rule, except as may be otherwise arranged with the Bureau of Economic Regulation in particular instances.

(d) The nature of each amendment must be indicated by use of the following uniform symbols, which shall be shown and explained in the publication in which they are used (see § 221.4 (e)) and which shall not be used for any other purpose:

- ♁ or (R) to denote reductions
- ◇ or (A) to denote increases
- △ or (C) to denote changes in wording which result in neither increases nor reductions in charges
- □ or (N) to denote addition.

(e) When a tariff, supplement or revised page canceling a previous issue omits points of origin or destination, route, rates, or rules contained in the previous issue, the new tariff, supplement, or revised page shall indicate the cancellation in the manner prescribed in paragraph (c) of this section, and, if such omission effects changes in charges or services, that fact shall be indicated by the use of the uniform symbols prescribed in paragraph (d) of this section.

(f) Matter brought forward without change from a tariff or revised page which has not become effective, also all matter brought forward without change from one supplement to another, must be designated "Reissued" in distinctive type and must show the original effective date and the number of the supplement, tariff, or revised page from which it is reissued. Reference marks may be used for this purpose providing the explanations thereof are made in the tariff or supplement in which the reference marks are used. Example: "No. ____ Reissued from C. A. B. No. 1, (or Supplement No. 1) effective ____________." (Here show the date upon which the item became effective in the tariff or supplement so named.)

(g) Every publication which consists partly but not wholly of matter established upon less than statutory notice shall show, in connection with each change made effective on less than statutory notice, a notation that such matter is issued on ____ day's notice under ____. (Here give specific reference to the Special Tariff Permission, decision, order, rule, or other authority.) (See § 221.8 (c).)

(h) Amended tariff matter that has been filed with the Board in error may be canceled in full or in part, on or before the date upon which such matter is to become effective, by refiling the existing matter erroneously amended upon less than 30 days' notice without obtaining special tariff permission for short-notice publication, provided that a full explanation of the attending circumstances is given in the letter of transmittal of the refiled matter (see § 222.2 (a) of this chapter). A tariff, supplement or revised page filed under this section must bring forward unchanged the existing tariff matter, properly reference-marked with the following notation:

> Cancellation of proposed tariff matter published in error; issued upon less than 30 days' notice under permission granted by § 221.8 of the Economic Regulations of the Civil Aeronautics Board.

§ 221.9 *Supplements.* (a) The first supplement to a tariff shall be identified and numbered on the upper right-hand corner of the title page as follows:

Supplement No. 1
to
C. A. B. No. ______

Subsequent supplements shall be numbered consecutively in like manner. Each supplement shall specify on its title page, immediately under the supplement number and C. A. B. number of the tariff supplemented, the publications which the supplement cancels, and shall also specify the supplements that are in effect. The statement that the supplement cancels conflicting portions of the tariff or prior supplements (without showing the numbers of the prior supplements) shall not be used; cancellations must be specific.

(b) If matter to be amended has been amended by a previous supplement, specific cancellation shall be made of the matter as contained in the previous supplement, and specific reference shall be made not only to the page number or numbers (or other identifying designations) of the previous supplement containing such matter, but to the page number or numbers (or other identifying designations) of the tariff or of the supplement in which the matter was originally established.

(c) A supplement shall contain either a list of carriers participating in the tariff, as amended or shall state that the list of participating carriers is "as shown in tariff," or "as shown in tariff and effective supplements," to which may be added "except ____." (Here show corrections in, additions to, or eliminations from the original list that are effected by the supplement.) Changes in or additions to the list of participating carriers in the tariff or previous supplements shall be listed alphabetically as provided in § 221.4 (h). When a participating carrier is eliminated by supplement, such supplement must also provide for the cancellation of all rates and routes in which the carrier concurs.

(d) The aggregate volume of supplemental matter currently in effect shall not exceed one-third of the volume of the principal tariff. The Board may direct the reissue of any tariff at any time.

§ 221.10 *Revised and additional pages.* (a) Reprints of existing pages of a loose-leaf tariff (see § 221.8) for the purpose of amending the existing page shall be known as "revised pages." Each such page shall show the number of the revision and the number of the page, and direct the cancellation of the previous page; for example, "1st Revised Page 1 cancels original Page 1," "2d Revised Page 1 cancels 1st Revised Page 1," "3d Revised Page 1 cancels 2d Revised Page 1." The term "revised page" must not be used to designate additional pages filed for the first time. (See paragraph (c) of this section.)

(b) When a revised title page is issued, the following notation shall be shown immediately under the effective date of the revised title page:

> Original tariff effective ____________. (Here show effective date of the original tariff.)

(c) When it becomes necessary to publish additional pages in a loose-leaf tariff, such additional pages must be designated "Original." If they are added between pages of the tariff, they must bear the same number as the preceding page, followed by a letter suffix; thus, "Original Page 4-A," "Original Page 4-B," etc. (Revisions of such pages must bear the same number, as "1st Revised Page 4-A.") If additional pages follow the last page of the tariff, they must be given the next consecutive numbers; thus, three pages added at the end of a tariff of 150 pages should be numbered "Original Page 151," "Original Page 152," and "Original Page 153." An original page may not be added for the purpose of changing rates or rules which concurrently appear on other pages of the tariff.

(d) When a revised page is issued which omits rates or rules previously published on the page which it cancels, and such rates or rules are published on a different page, the revised page shall make specific reference to the page on which the rates or rules will be found, and the page to which reference is so made will contain the following notation in connection with such rates or rules:

> For ____ (Here insert rates or rules, as the case may be) in effect prior to the effective date hereof, see page ____.

Subsequent revised pages of the same number shall omit this notation insofar as this particular matter is concerned.

(e) The following method shall be used in identifying and checking revised pages filed for the purpose of amending loose-leaf tariffs: Each time revised or additional original pages are filed, such revised and additional original pages shall show, in the lower right-hand corner, correction numbers running in consecutive order beginning with No. 1, each revised and additional original page issued and filed at the same time being given its individual consecutive correction number. A permanent check sheet, containing in numerical order a list of correction numbers beginning with No. 1 and the following provision, shall be filed with the original tariff:

Each time revised or additional original pages are received, check marks should be made on the check sheet opposite the correction numbers corresponding to those appearing in the lower right-hand corner of the revised or additional original pages. If pages are received not bearing consecutive correction numbers, the issuing officer or agent should be requested to furnish the page bearing the correction number for which a page has not been received.

(f) When protective covers for a loose-leaf tariff are used, only such information should appear thereon as will remain constant and in use during the life of the tariff.

(g) Supplements shall not be issued to loose-leaf tariffs except for the purpose of canceling the tariff, or as authorized by § 222.5 of this chapter, or as otherwise permitted by the Bureau of Economic Regulation.

PART 222—FILING AND POSTING TARIFFS OF AIR CARRIERS

AUTHORITY: §§ 222.1 to 222.9 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply secs. 403 and 404, 52 Stat. 992, 993; 49 U. S. C. 483, 484.

SOURCE: §§ 222.1 to 222.9 appear at 14 F. R. 3531.

§ 222.1 *Who may file.* (a) Local tariffs shall be filed by an officer or duly authorized agent of the carrier.

(b) Joint tariffs shall be filed by an officer of one of the carriers (to be known as the issuing carrier), or by the duly authorized agent of each of the carriers, parties thereto. Such filing will constitute filing for all carriers parties thereto.

(c) An agent will be deemed to be duly authorized to file a local tariff and/or a joint tariff when appropriate power of attorney has been given to him for the purpose as provided in this part.

(d) A joint tariff may be filed by an officer of the issuing carrier only when each of the other carriers parties thereto has given its concurrence as provided in this part.

(e) A carrier issuing a power of attorney to an agent, or a concurrence to another carrier, to publish and file certain rates shall not publish in its own tariffs rates which duplicate or conflict with those published by such agent or other carrier under such power of attorney or concurrence.

(f) The filing of a tariff with the Board in no way relieves an air carrier from liability for any violation of the act or of regulations issued thereunder.

§ 222.2 *Method of filing.* (a) All tariffs, supplements, and revised pages filed with the Board shall be accompanied by a letter of transmittal $8\frac{1}{2}$ by 11 inches in size, in form substantially as follows:

(Name of carrier or agent in full)

(Post Office address)

-------------------------------, 19---

Tariff Transmittal No. ------

To the CIVIL AERONAUTICS BOARD,
Tariffs Section, Washington 25, D. C.

Sent you for filing in compliance with the requirements of the Civil Aeronautics Act of 1938, is accompanying publications issued by --------------- and bearing C. A. B. No. ------ (or Supp. No. ------ to C. A. B. No. ------) (or ------ revised page No. ------ to C. A. B. No. ------), effective ------------, 19--, for the purpose of (here insert a comprehensive explanation of the accompanying tariff filing). This publication is concurred in by all carriers named therein as participants under continuing concurrences or powers of attorney now on file with the Civil Aeronautics Board, except the following named carriers, whose concurrences or powers of attorney are attached hereto:

(Signature) -----------------
(Title) ---------------------

(b) A letter may be accompanied by more than one publication.

(c) If receipt is desired by the filing carrier or agent, letters of transmittal must be sent in duplicate, and one copy showing the date of receipt by the Board will be returned to the sender.

(d) Three copies of each tariff, supplement, or revised page must be transmitted to the Board in one package and under one letter of transmittal. The word "tariffs" must appear on the outside of the package, which must be addressed in conformity with the letter of transmittal.

(e) No tariff, supplement, or revised page will be received by the Board unless it is delivered to it free from all charges, including claims for postage.

(f) Tariff publications will be received for filing only by delivery thereof to the Board through normal mail channels or by delivery thereof by hand directly to that office of the Board charged with responsibility for maintaining the official file of tariffs, and will be received for filing only during the established business hours of the Board. A tariff publication will be deemed filed only upon actual receipt by the Board in accordance with such requirements, and any required period of notice will commence to run only from the time of such filing. Tariff publications received by the Board but subsequently rejected for filing will not be returned.

(g) Each carrier shall post and make available for public inspection at each of its stations or offices which are in charge of a person employed exclusively by the carrier, or by it jointly with another person, and at which property is received for transportation or at which tickets for passenger transportation are sold, all of the currently effective tariffs to which it is a party and containing the rates and rules applicable to the transportation by it of the property received or the passengers to whom tickets are sold at such stations or offices. A carrier will be deemed to have complied with the requirement that it "post" tariffs, if it maintains at each such station or ticket office a file of current tariffs in complete form.

(h) Each carrier shall maintain permanently at its principal or general office a complete file of all tariffs issued by it or by its agents, including those tariffs in which it concurs.

(i) The granting of authority to issue tariffs under powers of attorney or concurrences does not relieve the carriers conferring the authority from the necessity of complying with the Board's regulations with regard to posting tariffs. Tariffs issued under such authority must be posted as required by these regulations.

(j) Each file of tariffs shall be kept in complete and accessible form. Employees of the carrier shall be required to give any desired information contained in such tariffs, to lend assistance to seekers of information therefrom, and to afford inquirers opportunity to examine any of such tariffs without requiring the inquirer to assign any reason for such desire.

§ 222.3 *Application for special tariff permission.* (a) The Civil Aeronautics Act of 1938 authorizes the Board in its discretion and for good cause shown to permit changes in rates on less than statutory notice, and also to permit departure from the Board's regulations. The Board will exercise the power only in cases where actual emergency and real merit are shown. Desire to meet the rates of a competing carrier that has given statutory notice of change in rates will not of itself be regarded as good cause for permitting change in rates or other provisions on less than statutory notice. Clerical or typographical errors in tariffs constitute good cause for the exercise of this authority, but every application based thereon must plainly specify the error together with a full statement of the attending circumstances, and must be presented with reasonable promptness after discovery of the error.

(b) Applications for permission to make changes or additions in tariffs on less than statutory notice, or to establish rates, fares, charges, rules and regulations in an initial tariff on less than 30 days' notice, or for waiver of the provisions of this section, must be made by the carrier or agent that holds authority to file the proposed publication.

(c) If the application requests permission to make changes in joint tariffs it must be filed for and on behalf of all carriers parties to the proposed change, and must so state.

(d) Two copies of applications (including amendments thereto and exhibits made a part thereof) shall be sent to the Civil Aeronautics Board, Bureau of Economic Regulation, Tariffs and Service Division, Washington 25, D. C.

(e) Applications for permission to publish on less than statutory or 30 days' notice shall be made on paper $8\frac{1}{2}$ by 11 inches, shall be in substantially the form shown herein below, and shall give all the information required by this rule, together with any other pertinent facts. They shall be numbered consecutively and must bear the signature of the carrier's agent or officer, specifying his title.

When the application is made by an agent, appropriate change should be made in the introductory and closing paragraphs of this form:[1]

(Address)

(Date)

To the CIVIL AERONAUTICS BOARD,
Bureau of Economic Regulation,
Tariffs and Service Division,
Washington 25, D. C.

Special Tariff Permission Application No. -------.

----------------, by ---------------------- (Name of carrier) (Name of officer, specifying title) ---------- for and on behalf of all carriers parties to its tariff C. A. B. No. ------[1] applies to the Civil Aeronautics Board for permission under Section 403 of the Civil Aeronautics Act of 1938 and the Economic Regulations adopted pursuant thereto, to put in force the following tariff provisions to become effective ------ days after the filing thereof with the Civil Aeronautics Board:

(Here show matter as directed by par. (f) (1))

Your applicant further represents that the said:

(Here state in numbered paragraphs the data -------------------- required by par. (f))

(Name of carrier)

By: ------------------------
(Name and title)

(f) Applications for permission to publish on less than statutory or 30 days' notice shall show the following information:

(1) The proposed tariff provisions, clearly and completely. For that purpose, an accompanying exhibit may be used if properly identified and referred to in the application. If the proposed provisions consist of rates, all points of origin and destination must be shown or definitely indicated; if permission is sought to establish or change a rule, the exact wording of the proposed rule must be given.

(2) The C. A. B. numbers of the tariffs in which the proposed rates or rules will be published. If publication is to be made in supplements or revised pages, this fact shall be shown.

(3) The rates or rules which it is desired to initiate or change, and the C. A. B. numbers of the tariffs (showing supplement and loose-leaf page numbers) in which they are currently effective. Where the matter to be shown is voluminous, or for other reasons is difficult of presentation, it may be included in an accompanying exhibit properly identified and referred to in the application. The extent to which cancellations will be made must be definitely indicated.

(4) The names of all air carriers and agents advised of the proposed rates or rules and whether they have been advised that it is proposed to establish such rates or rules on less than statutory or 30 days' notice. If such carriers or agents have expressed their views in regard to the proposed provisions, a brief statement of their views shall be given.

(5) The special circumstances or unusual conditions which are relied upon as justifying the requested permission, together with any related facts or circumstances which may aid the Board in determining whether the requested permission is justified. (See paragraph (a) of this section.)

(g) Application seeking waiver of the provisions of this tariff regulation must conform to the requirements of this paragraph insofar as appropriate, and such waiver may be permitted by the Bureau of Economic Regulation of the Board.

(h) A Special Tariff Permission must be used in its entirety and in the manner set forth therein. If it is not desired to use the permission as granted, and less or more extensive or different permission is desired, a new application complying with the provisions of § 222.3 in all respects and referring to the previous permission must be filed.

(i) Any air carrier or foreign air carrier is hereby authorized to file initial tariffs upon less than 30 days' notice or to make tariff changes upon less than statutory notice without further action by the Board upon the following conditions having been fulfilled:

(1) An application for permission to make tariff changes upon less than statutory notice or file an initial tariff upon less than 30 days' notice has been duly filed in the form, and setting forth the information, required by this section;

(2) Such application has been approved in writing by the Director of the Bureau of Economic Regulation of the Board; and

(3) The initial tariffs shall be filed, and changes in tariffs shall be made, upon such notice as is approved by the Director of the Bureau of Economic Regulation, and shall be only those specifically approved.

(j) In all other cases, initial tariffs shall be filed, and tariff changes shall be made, upon less than 30 days' notice only when and to the extent that a particular application therefor has been approved by the Board.

(k) The Director of the Bureau of Economic Regulation will approve or disapprove in writing any application which has as its only purpose the correction of mechanical, clerical or administrative errors, or any application the disposition of which does not involve new and substantial questions of policy, but in acting upon any such application the Director will be governed by and act in accordance with the provisions of this paragraph. The Director can refer any application to the Board for disposition, and will so refer any application which he is not authorized to approve or disapprove.

(l) Any application disapproved by the Director pursuant to this paragraph is thereby denied, subject to review by the Board as hereinafter provided. In the event of such disapproval, an applicant may within 5 days after it has received written notice thereof file a written request for review of the denial resulting from such disapproval. The Board will thereupon review the matter and enter an order finally disposing of the application.

§ 222.4 *Filing of initial tariffs.* Initial tariffs shall be filed with the Board at least 30 days prior to their effective date.

§ 222.5 *Suspensions.* Whenever the operation of any provision of a tariff, supplement, or loose-leaf page is suspended by the Board, the carrier or agent whose tariff is affected by such suspension shall immediately file, post, and publish a supplement prepared in such form and manner as may be required by the Bureau of Economic Regulation. Protests against and requests for suspension of tariff amendments under section 1002 (g) of the act will not, except under unusual circumstances which must be fully explained, be considered unless they are received by the Board within 5 days after the date such tariff amendments are filed with the Board.

§ 222.6 *Concurrences.* (a) A carrier desiring to give another carrier authority to publish rates or rules in which they, or they and other carriers join, shall give to such other carrier a concurrence in the form set forth below. Concurrences shall be prepared on good paper of durable quality, 8½ by 11 inches in size. They must be prepared in triplicate. The original shall be filed with the Board, the duplicate sent to the carrier to which such authorization is directed, and the third copy retained by the issuing carrier. When more than two carriers join in the same publication each of the concurring carriers shall give its concurrence to the issuing carrier. If not restricted, such concurrence will cover any tariff, supplement, or revised pages published by the issuing carrier in which the concurring carrier is shown as participating.

CONCURRENCE

No. --------
Cancels No. --------

(Correct corporate name of carrier)

(Post Office address)

-------------------------, 19----

Know all men by this instrument:

That, effective on the -------- day of -------------------------------, 19 ------, --
(Show correct corporate name of carrier giving concurrence)

----
assents to and concurs in the publication and filing of any tariff, or supplement, or revised page which---------------------------
----
(Show correct corporate name of carrier to whom concurrence is given)

----
may publish and file and in which----------

(Show correct corporate name of carrier giving concurrence)
is shown as a participating carrier, and----

(Show correct corporate name of carrier giving concurrence)

hereby makes itself a party thereto and bound thereby. (If it be desired to restrict or limit the concurrence, continue at this point with the statement. "In so far only as such tariff provides" following here with

[1] The form may be modified to the extent necessary to describe tariffs or name carriers but both shall be specifically set forth in application.

a clear and definite statement of the scope of the concurrence which is being given.)

(Correct corporate name of carrier)

By: ________________

Attest:

________________, Secretary

[CORPORATE SEAL]

Duplicate mailed to ____, ________________
(Correct corporate name of carrier)

____
(Address)

____
(Date)

(b) A carrier giving a concurrence or concurrences may not itself publish rates or rules which would duplicate or conflict with rates or rules published under such concurrence or concurrences; and must exercise care to avoid giving concurrences to two or more carriers which could result in duplication of or conflict in rates or rules to which it is a party.

(c) A concurrence may be revoked upon not less than 45 days' notice to the Board by filing with the Board and serving at the same time a copy thereof on the carrier to whom the concurrence was given a notice of revocation of concurrence prepared in a manner similar to that prescribed in § 222.7 (d) in respect to notice of revocation of power of attorney.

§ 222.7 *Powers of attorney.* (a) The following form shall be used by a carrier to give authority to an agent to publish and file tariffs, supplements and revised pages, for and on behalf of such carrier. (See § 222.1 (a), (b) and (c)). Powers of attorney shall be prepared on good paper of durable quality, 8½ by 11 inches in size. They must be prepared in triplicate. The original shall be filed with the Board, the duplicate sent to the agent designated therein, and the third copy retained by the issuing carrier.

POWER OF ATTORNEY

No. ________
Cancels No. ________

____
(Corporate name of carrier)

____
(Post-office address)

________________, 19____

Know all men by this instrument:

That, (insert correct corporate name of carrier) makes and appoints (name of principal agent) attorney and agent, (1) for it alone, and (2) for it jointly with other carriers, to publish and file for it all tariffs, supplements, and revised pages it is required to publish and file by the Civil Aeronautics Act of 1938, and the regulations of the Civil Aeronautics Board issued pursuant thereto, and ratifies and confirms all that said attorney and agent may lawfully do by virtue of the authority herein granted and assumes full responsibility for the acts and failures to act of said attorney and agent.

(If the authority is to be restricted state specifically what authority is conferred, i. e., property rates, charges, rules, regulations, and routings not including air express rates, charges, rules, regulations, or routings; passenger fares, baggage rates, rules, regulations, and routings; Universal Air Travel Plan Tariff, supplements or revised pages thereto and successive issues thereof.)

And further, that (insert correct corporate name of carrier) makes and appoints (name of alternate agent) alternate attorney and agent to do and perform the same acts and exercise the same authority granted to (name of principal agent) in the event and only in the event of the death or disability of (name of principal agent).

By ________________
Vice president—Traffic

Attest:

________________, Secretary-Treasurer

[CORPORATE SEAL]

Duplicate mailed to: (Name and address of agent.)

The term "disability" as used in the power of attorney shall mean resignation, permanent transfer to other duties, or other permanent absence, of the principal agent, and not temporary absence of the principal caused by vacation, illness, or other similar reasons.

(b) Powers of attorney, if executed without modification, confer unlimited authority to publish local rates for the carrier issuing the power of attorney and to publish joint rates for such carrier and such other carriers as shall have issued the necessary authority. If it is desired to limit the authority granted to the agent, the form may be modified by adding at the end of the first paragraph the statement: "This authority is restricted to the filing of the publications (or types of publications) set forth below", or by otherwise clearly stating the extent of the authority granted. If it is desired to limit the authority granted to publication of a particular tariff or tariffs, this may be done by giving a sufficiently accurate description of the title page of each tariff to identify it, and by showing the C. A. B. number, if known. If it is intended that the authority granted shall include supplements to, or reissues of, specifically named tariffs, that fact should be made clear by adding after the designation of the tariff, "supplements thereto and successive issues thereof."

(c) Powers of attorney may not contain authority to delegate to another the power thereby conferred. In giving authority to an agent to publish and file for the carrier by which such authority is issued, care must be taken to avoid duplicating to two or more agents authority which, if used, would result in conflicting rates or other provisions.

(d) A power of attorney may be revoked upon not less than 45 days' notice to the Board by filing with the Board, and serving at the same time a copy thereof on the agent in whose favor the power of attorney was executed, a notice of revocation in the form set forth and prepared in conformity with the requirements prescribed in this paragraph in respect to powers of attorney. Such revocation may be made for the purpose of eliminating agency publication of tariffs (generally or specifically), for the purpose of changing the authority previously granted to an agent without changing the agent, or for transferring authority from one agent and alternate to another agent and alternate. If the revocation is for the purpose of changing the authority previously granted to an agent without changing the agent the revocation notice must be accompanied by the new power of attorney and the form of notice set forth below should be modified to include specific reference to the new power of attorney. When it is desired to transfer authority from one agent and alternate to another agent and alternate, such transfer may be accomplished by filing a new power of attorney for the agent and alternate thereafter to serve, which shall specifically cancel the previous power of attorney. Such new powers of attorney shall bear no effective date. The originals thereof should not be sent direct to the Board but must be forwarded to the new principal agent who, after he has secured all the necessary authorities, must file the originals with the Board all at one time together with three copies of a take-over supplement for each tariff taken over. Such powers of attorney will become effective upon the date they are received by the Board. The power of attorney issued for the purpose of the transfer of agents shall not increase nor decrease the authority contained in the power of attorney being canceled.

NOTICE OF REVOCATION OF POWER OF ATTORNEY

____
(Correct corporate name of carrier)

____
(Post office address)

________________, 19____

Know all men by this instrument:

Effective ________________, 19____, power of attorney No. ____ issued by ________ (Correct ________________ corporate name of carrier) in favor of ________________ (Name of agent and of alternate, if any) is cancelled and revoked.

____
(Correct corporate name of carrier)

By: ________________

Attest:

________________ Secretary

[CORPORATE SEAL]

Duplicate mailed to ________________
(Name of agent)

____
(Address)

____
(Date)

(e) A new agent, or an alternate assuming the duties of his principal, shall file with the Board and post and publish a supplement to each of the effective tariffs issued by the agent superseded. The title page of such supplement shall show no effective date but shall contain a statement substantially as follows: "On and after (here show the effective date of the power of attorney of a new agent, or the date on which the principal ceased to act) this publication shall be considered as the issue of (here show name of new agent or alternate)." When issued by a new agent such supplement shall also contain a list of participating carriers together with reference to the new power of attorney issued by each such carrier. An alternate shall submit to the Board on or before the date of filing of such supplement a sworn statement setting forth the facts which justify such exercise of authority. After an alternate has once exercised the authority granted him, the principal may not thereafter act under the same power of attorney.

§ 222.8 *Revocation of concurrence or power of attorney.* When a power of attorney or concurrence is revoked, appropriate revision or cancellation of the traiff or tariffs must immediately be made effective upon statutory notice. In the event of failure to make such revision or cancellation, the rates in such tariff or tariffs remain applicable and must be observed.

§ 222.9 *Statement of filing with foreign governments.* Every air-carrier tariff, supplement, or revised page containing rates or rules which by treaty, convention, or agreement entered into between any foreign country and the United States are required to be filed with that foreign country, shall include a statement substantially as follows:

The rates, fares, charges, classifications, rules, regulations, practices, and services provided herein have been filed in each country in which filing is required by treaty, convention, or agreement entered into between that country and the United States, in accordance with the provisions of the applicable treaty, convention, or agreement.

PART 223—TARIFFS OF AIR CARRIERS; FREE AND REDUCED RATE TRANSPORTATION

AUTHORITY: §§ 223.1 to 223.9 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply secs. 403 and 404, 52 Stat. 992, 993, 49 U. S. C. 483, 484.

SOURCE: §§ 223.1 to 223.9 appear at 14 F. R. 3534.

§ 223.1 *Definitions.* As used in this part, unless the context otherwise requires—

(a) "Carrier" means an air carrier or a foreign air carrier.

(b) An "affiliate" of a carrier means a person—

(1) Who controls such carrier, or is controlled by such carrier or by another person who controls or is controlled by such carrier, and

(2) Whose principal business in purpose or in fact is:

(i) The holding of stock in one or more carriers, or

(ii) Scheduled transportation by air or the sale of tickets therefor, or

(iii) The operation of one or more airports, one or more of which are used by such carrier or by another carrier who controls or is controlled by such carrier or who is under common control with such carrier by another person, or

(iv) Activities devoted to the scheduled transportation by air conducted by such carrier or by another carrier which controls or is controlled by such carrier or which is under common control with such carrier by another person.

(c) Within the meaning of this section, "control" means the beneficial ownership of more than 40 percent of outstanding voting capital stock unless, as to the specific case, the Board shall have determined in a proceeding pursuant to section 408 of the act that control does not exist; such control may be direct or by or through one or more intermediate subsidiaries likewise controlled or controlling through beneficial ownership of more than 40 percent of outstanding voting capital stock.

(d) "Pass" means a written authorization issued by a carrier for free or reduced-rate transportation of persons or property; "annual pass" means such an authorization effective over a period of a calendar year; "term pass" means such an authorization effective over a specified period of less than a year; "trip pass" means such an authorization for a single one-way trip or round trip (whether the return trip is made via the same route as the outbound trip or a different one) between designated points.

(e) "Free transportation" means the carriage by a carrier of any person or property (other than property owned by such carrier) in air transportation without compensation therefor; "reduced-rate transportation" means such carriage for a compensation less than that under the rate, fare, or charge published in the tariffs of such carrier, on file with the Board and otherwise applicable to such carriage.

§ 223.2 *Persons to whom free and reduced rate transportation may be furnished.* Subject to the provisions of the act and the orders, regulations (including this regulation) and rules of the Board now or hereafter in effect, any carrier may at its option provide free or reduced-rate transportation to any or all classes of persons specifically mentioned in section 403 (b) of the act; and in addition thereto, all carriers engaged in overseas or foreign air transportation may furnish free or reduced-rate transportation to:

(a) Directors, officers, and employees and members of their immediate families, of any affiliate of such carrier, the name of which affiliate currently is included in the list of affiliates filed by such carrier pursuant to § 223.7 (a) (3);

(b) Directors, officers, and employees and members of their immediate families, of any person operating as a common carrier by air, or in the carriage of mails by air, or conducting transportation by air, in a foreign country, but only over routes and in territories served in such foreign country; and

(c) Other persons to whom such carrier is required to furnish free or reduced-rate transportation by law or by a contract or agreement, now or hereafter in effect, between such carrier and the government of any country served by such carrier, but only to the extent so required and only if such contract or agreement is filed with the Board and if the provisions thereof relating to such transportation are not disapproved by the Board as being contrary to the public interest.

§ 223.3 *Passes to be issued.* No carrier shall furnish any free or reduced-rate transportation unless a pass therefor has been issued, except that passes need not be issued:

(a) For any transportation provided for in any tariff on file with the Board and currently effective when such transportation is furnished;

(b) For necessary travel of the carrier's own directors, officers, or employees in the performance of their official duties;

(c) For free or reduced-rate transportation of persons injured in aircraft accidents or of physicians or nurses attending such persons, or with the object of providing relief in cases of general epidemic, pestilence, or other calamitous visitation; or

(d) For free or reduced-rate transportation authorized in any other section of this chapter or order of the Board now or hereafter in effect.

§ 223.4 *Form of pass.* No carrier shall issue any form of pass other than an "annual", "term", or "trip" pass. Every pass shall be issued upon the express condition that it is subject to suspension or cancellation for the abuse of the privileges accorded thereunder, and must show on its face, at least, the name of the person or persons who, or whose property, is entitled to receive free or reduced-rate transportation. Each pass must bear either the signature in ink of an official named in the list referred to in § 223.7, or the facsimile signature of such an official and the countersignature in ink of some other official or responsible subordinate who is designated by name and title on the pass, and before presented for transportation such pass must bear the signature in ink of the person to whom issued; *Provided*, That regular tickets or bills of lading, stamped with a suitable notation, may be used as trip passes, and when so used need not conform to the provisions of this section as to form.

§ 223.5 *Carrier's records.* Each carrier shall maintain a record of all passes issued by it, which record shall be filed in such manner as to be accessible and convenient for examination, and shall contain the following information: The type of pass; dates of issuance and expiration; number; to whom issued, including name, address, and eligibility under the act and under this part; privileges accorded thereunder; points between which transportation is authorized, or, in the case of "annual" and "term" passes, the route number or system or particular points, as may be appropriate; and the name of the official upon whose authorization the pass was issued. All correspondence or memorandums relating to free or reduced-rate transportation shall be retained and made a part of the carrier's records. In the case of reduced-rate transportation, the records shall show the amount of the charge assessed or assessable.

§ 223.6 *Carrier's rules.* Each carrier shall file with the Board three copies of all instructions to its employees, and of all company rules and regulations, governing its practices in connection with the issuance and interchange of passes. If no instructions, rules, or regulations are in effect, then three copies of a general statement by an appropriate official of the carrier, comprehensively describing its practices in connection with the issuance and interchange of passes must be filed. Three copies of any change in any such instructions, rules, regulations, or statement of practices must be filed with the Board within 20 days after the effective date of such change.

§ 223.7 *Filing of lists.* (a) Before issuing any pass each carrier shall file with the Board:

(1) A list containing the name and title of each of its officials upon whose authorization passes may be issued,

(2) A list containing the name and title of each of its officials who are authorized to request passes from other carriers, and

(3) In the case of issuance of passes to directors, officers, employees, or members of their immediate families, of any affiliate of such carrier, a list containing all of such carrier's affiliates and showing the exact relationship of each such affiliate to such carrier as respects control and principal business.

(b) Any change in any of such lists must be filed with the Board within 15 days after such change is effective; *Provided*, That an affiliate not previously included in any list filed with the Board must be included in a new list prior to the issuance of any pass to any person authorized to receive such pass by reason of such affiliation.

§ 223.8 *Application for authority to carry other persons.* Any carrier desiring special authorization under section 403 (b) of the act to furnish free or reduced-rate overseas or foreign air transportation to a person or persons not described in that section nor in § 223.2 may apply to the Board, by letter or other writing, for such authorization. The application shall state the identity of the person or persons to whom, and the points between which, such transportation is to be furnished, the time or approximate time of departure, and the carrier's reasons for desiring to furnish such transportation. The application shall contain a definite statement that the carrier is willing and intends to furnish such transportation if authority to do so is granted by the Board. Such application shall be deemed to have been approved and authority for the transportation granted unless the Board shall otherwise advise the carrier within 10 days after the application is received by the Board; *Provided*, That no application filed less than 10 days before the proposed transportation is to be furnished shall be deemed approved unless notice of such approval is received by the carrier prior to the furnishing of the transportation.

§ 223.9 *Effect on other regulations.* Nothing contained herein shall be construed as repealing or amending any provision of any other section of this subchapter.

PART 224—TARIFFS OF AIR CARRIERS; FREE AND REDUCED RATE TRANSPORTATION—ACCESS TO AIRCRAFT FOR SAFETY PURPOSES

AUTHORITY: §§ 224.1 to 224.3 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply secs. 601 to 610, 52 Stat. 1007 to 1012, 49 U. S. C. 551 to 560.

SOURCE: §§ 224.1 to 224.3 appear at 14 F. R. 3536.

§ 224.1 *Safety inspectors.* Every air carrier shall carry, without charge, on any aircraft which it operates any duly authorized official or employee of the Board or of the Administrator of Civil Aeronautics who has been assigned to the duty of inspecting during flight such aircraft, its engines, propellers, appliances, route facilities, operational procedures or airman competency.

§ 224.2 *Requests for access to aircraft.* Such carriage without charge shall be granted, (a) on presentation to the appropriate agents of the air carrier of a certificate identifying the person presenting it as being entitled to such carriage signed by the Secretary of the Civil Aeronautics Board, or by the Assistant Administrator for Aviation Safety of the Office of the Administrator of Civil Aeronautics, or by any of the regional administrators of the Civil Aeronautics Administration, and signed by the person presenting it; and (b) on delivery to the appropriate agents of the air carrier, in duplicate, of a "Request for Access to Aircraft" on a form supplied by the Board or by the Administrator stating that the signer thereof desires access to a certain aircraft of the air carrier from a named point of departure on a designated date and hour to a named destination for the purpose of performing his official duties during flight of such aircraft. The air carrier shall retain one copy of each such request. On or before the 10th day of each month, each air carrier shall forward one copy of all such requests received by it during the second preceding calendar month to the Secretary of the Civil Aeronautics Board, Washington 25, D. C.

§ 224.3 *Traffic control and communications personnel.* Any air carrier may carry without charge on any aircraft which it operates any airway traffic control manager or assistant manager or any communications supervisor or assistant communications supervisor of the Administrator of Civil Aeronautics (including supervising officers of such persons) for the purpose of more fully and adequately acquainting such persons with the problems affecting airway traffic control and communications: *Provided, however,* That no such person shall be carried without charge on a round trip by any air carrier for such purpose more often than once in each year.

Transportation of Mail

PART 231—TRANSPORTATION OF MAIL; MAIL SCHEDULES

AUTHORITY: §§ 231.1 to 231.7 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 405 (e), 52 Stat. 994, 49 U. S. C. 485.

SOURCE: §§ 231.1 to 231.7 appear at 14 F. R. 3536.

§ 231.1 *Filing of general schedules.* Each air carrier authorized to engage in air transportation shall file with the Board a statement, to be known as a "general schedule," showing the points between which the air carrier is authorized to engage in air transportation, all schedules of aircraft which will be operated by the air carrier between such points on the date the general schedule is to become effective, the time of arrival and departure at each point, and the frequency of each schedule. Prior to the date it engages in any scheduled air transportation each such air carrier shall file a general schedule with the Board: *Provided, however,* That an air carrier authorized to engage in air transportation on October 1, 1939, may file its first general schedule hereunder at any time within 20 days thereafter.

§ 231.2 *Form of schedules.* All general schedules and amendments thereto shall be in loose-leaf form, with pages $8\frac{1}{2}$ by 11 inches in size, and shall be plainly typewritten, stereotyped, or mimeographed on durable paper. Each page shall be printed on one side only, and shall have a left margin at least 1 inch wide.

§ 231.3 *Title page.* The first page of a general schedule shall be designated as a title page and include the following:

(a) Name of carrier,
(b) The general schedule number,
(c) A brief description of the contents,
(d) The date of issue,
(e) An effective date, and
(f) The issuing officer's name and address.

§ 231.4 *Schedule pages.* (a) All pages following the title page shall be consecutively numbered and known as schedule pages. The name of the air carrier shall appear at the top of each schedule page, the page number in the upper right-hand corner, and the general schedule number in the upper left-hand corner. At the bottom of each schedule page shall appear its date of issue and effective date.

(b) Each schedule page shall indicate the route number, if any, and the terminal and intermediate points served by the schedules appearing on the page, shall show the time of arrival and departure of each schedule at such points, and the types of equipment operated on each schedule. Each schedule shall be assigned a trip or flight number. Each schedule shall contain an explanation of all symbols used thereon.

§ 231.5 *Additions and changes.* (a) An additional schedule may be added to a general schedule either by filing a new schedule page or by revising an existing schedule page. A change in a schedule page to show the addition of a new schedule or to show a change in an existing schedule shall be effected by reproducing the entire page. Such changed schedule page shall be designated a revised page, and shall cancel the former page; for example:

1st revised page 1, cancels original page 1.

(b) Any change in an existing schedule on which mail is being transported shall be filed with the Board at least 10 days prior to the effective date of such change: *Provided, however,* That any change in schedule, or the addition of a new schedule, required by an order of the Postmaster General under section 405 (e) of the act shall be filed with the Board by the air carrier on or before the effective date of such order: *And provided further,* That if the Board postpones the effective date of any such order pursuant to section 405 (e) of the act, the air carrier shall revise its general schedule to conform to the action taken on such order by the Board and shall make such revision as promptly as possible but not more than 10 days after the effective date of such order.

(c) Any change in a nonmail schedule, or the addition of a new nonmail schedule, shall be filed with the Board on or before the effective date thereof.

§ 231.6 *Number of copies.* Each air carrier shall transmit to the Board for filing three copies of each general schedule or revised page, accompanied by letters of transmittal (in duplicate if a receipt is desired) listing the general schedule or revised pages that are transmitted for filing. The letter of transmittal and all copies of the material listed therein shall be included in one package addressed to:

Civil Aeronautics Board,
Bureau of Economic Regulation
Tariffs and Service Division,
Washington 25, D. C.

§ 231.7 *Effect of filing.* The filing of a schedule, or a new or revised schedule page, with the Civil Aeronautics Board, shall not relieve an air carrier of requirements made by any other governmental instrumentality, as to filing or reporting.

PART 232—TRANSPORTATION OF MAIL; REVIEW OF ORDERS OF POSTMASTER GENERAL

Sec.
232.1 Application for review.
232.2 Form and contents of application.
232.3 Serving copies of application.

AUTHORITY: §§ 232.1 to 232.3 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 405 (e), 52 Stat. 994, 49 U. S. C. 485.

SOURCE: §§ 232.1 to 232.3 appear at 14 F. R. 3537.

§ 232.1 *Application for review.* Any person who would be aggrieved by an order of the Postmaster General issued under and within the meaning of section 405 (e) of the act may, within not more than 10 days after the issuance of such order, apply to the Board for a review thereof. An application filed hereunder shall be deemed to have been filed on the date on which it is actually received by the Board at its offices in Washington, D. C.

§ 232.2 *Form and contents of application.* (a) An application filed hereunder may be made in writing or by telegram. An application in writing shall be conspicuously entitled Application for a Review of Order of the Postmaster General Issued under section 405 (e) of the Civil Aeronautics Act, shall specify the schedule affected and identify the order complained of, and shall specify the manner in which the applicant is or would be aggrieved by the order, the relief sought, and the facts relied upon to establish that the public convenience and necessity require that such order be amended, revised, suspended, or canceled by the Board. The execution, number of copies, and verification of a written application filed hereunder, and the formal specifications of papers included in such application shall be in accordance with the requirements of the Rules of Practice relating to applications generally (see Part 302 of this chapter).

(b) If the application for a review is made by telegram, such telegram shall succinctly state the substance of the matters to be set forth in the written application, and shall be confirmed and followed by an application in writing.

§ 232.3 *Serving copies of application.* At the time a written or telegraphic application is filed hereunder a copy therof shall be served by personal service or registered mail upon the Postmaster General and upon the air carrier operating or ordered to operate the mail schedule in question. Each copy so served shall be accompanied by a letter of transmittal stating that such service is being made pursuant to this section.

PART 233—TRANSPORTATION OF MAIL; FREE TRAVEL FOR POSTAL EMPLOYEES

Sec.
233.1 Postal employees to be carried free.
233.2 Credentials required.
233.3 Requests to be filed.
233.4 Issuance of credentials and transportation request forms by Post Office Department.

AUTHORITY: §§ 233.1 to 233.4 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 405 (m), 52 Stat. 994, 49 U. S. C. 485.

SOURCE: §§ 233.1 to 233.4 appear at 14 F. R. 3537.

§ 233.1 *Postal employees to be carried free.* Every air carrier carrying the mails shall carry, on any plane that it operates and without charge therefor, the persons in charge of the mails when on duty, and the following officers, agents, and inspectors of the Post Office Department, when such persons are traveling on official business relating to the transportation of mail by aircraft and are duly accredited as hereinafter provided:

(a) Postmaster General.

(b) The Executive Assistant to the Postmaster General.

(c) The First Assistant Postmaster General; the Third Assistant Postmaster General; the Fourth Assistant Postmaster General; the Second Assistant Postmaster General; his Confidential Assistant; his Under Second Assistant and his four Deputy Second Assistants; the Administrative Officer, Air Postal Transport; the Solicitor of the Post Office Department and the Associate Solicitor and any attorney in the Office of the Solicitor who at the time is assigned by the Solicitor to handle matters relating to the transportation of mail by aircraft; the Chief Inspector and the Assistant Chief Inspector.

(d) The Director of Domestic Air Postal Transport and the Director of Foreign Air Postal Transport.

(e) The five Regional Superintendents, and the five Assistant Regional Superintendents, Air Postal Transport, located respectively at New York, N. Y., Chicago, Ill., San Francisco, Calif., Atlanta, Ga., and Fort Worth, Texas; the Regional Superintendents and Assistant Regional Superintendents at Large, Air Postal Transport.

(f) The General Superintendent, 13th Division, Railway Mail Service, located at Seattle, Wash., and the District Superintendent and Assistant District Superintendent, Railway Mail Service, located at Anchorage, Alaska, when traveling between Seattle, Wash., and Alaska or within Alaska on official business relating to the transportation of mail to, from and within Alaska.

(g) Any inspector of the Post Office Department.

(h) Any additional agent or officer of the Post Office Department designated by the Postmaster General.

§ 233.2 *Credentials required.* (a) Any person described in paragraphs (a) to (f), inclusive, of § 233.1 shall be deemed to be duly accredited upon exhibition of a certificate of the Postmaster General that the bearer is one of the persons so described and is entitled to free transportation when traveling on official business relating to the transportation of mail by aircraft, and bearing the signature of the person so described.

(b) Any person described in paragraphs (g) and (h) of § 233.1 shall be deemed to be duly accredited upon exhibition of proper credentials evidencing that he is an inspector, officer, employee, or agent of the Post Office Department, and upon presentation of a Request for Free Transportation by Air (on such form as the Post Office Department may prescribe) executed by him in triplicate and stating:

a. The points from and to which the person is to be furnished free transportation;
b. The tariff fare for the transportation requested, and
c. The official position of the traveller and that such travel is on official business relating to the transportation of mail by aircraft.

§ 233.3 *Requests to be filed.* Each air carrier on or before the 20th day of each month shall forward one copy of every Request for Free Transportation by Air accepted by it during the preceding calendar month, to the Secretary, Civil Aeronautics Board, Washington 25, D. C., and one copy to the Deputy Second Assistant Postmaster General, Post Office Department, Washington, D. C.[1]

§ 233.4 *Issuance of credentials and transportation request forms by Post Office Department.* With regard to free air travel by the persons described in § 233.1 the Postmaster General shall be responsible (a) for the issuance of proper credentials, (b) for prescribing proper

[1] The third copy shall be preserved by the air carrier in its records in compliance with the requirements of this subchapter. See § 249.4 item 48-B.

transportation request forms where required, and (c) for authorizing such travel, subject to such rules and regulations as he may prescribe.

PART 234—TRANSPORTATION OF MAIL; PETITIONS FOR DETERMINATION OF RATES

AUTHORITY: §§ 234.1 to 234.7 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 406, 52 Stat. 998, 49 U. S. C. 486.

SOURCE: §§ 234.1 to 234.7 appear at 14 F. R. 3537.

§ 234.1 *Number of copies.* Ten copies of each petition shall be filed with the Board. Only one of such copies need be actually executed on behalf of the petitioner. The names and titles of all signing officers shall be clearly typed or printed beneath their signatures. All unexecuted copies filed with the Board shall contain typed, printed, or facsimile signatures.

§ 234.2 *Verification.* The signed copy of each petition shall be verified by the petitioner. If the petitioner is a partnership, such verification shall be made by two or more of the partners. If it is a corporation, business trust, or other similar organization, the petition shall be verified by three of its officers, who shall be, respectively, the chief executive, the chief financial, and the chief operating officer. In the event of the unavailability of any such officer, the acting officer charged with the responsibility for his duties may execute such verification in his stead. Every such verification shall set forth that the persons verifying the same have read, and are familiar with the contents of, the petition and the attached exhibits; that they intend and desire that, in granting or denying the relief applied for, the Board shall place full and complete reliance on the accuracy of each and every statement therein contained; that they are familiar with the facts therein set forth, and that, to the best of their information and belief, every statement contained in the petition is true and no such statement is misleading. Every such verification shall be subscribed and sworn to before a notary public or other officer authorized to administer oaths in the jurisdiction in which such petition is executed.

§ 234.3 *Amendments.* If, after receipt of any petition, the Board shall request the petitioner to supply it with additional information, such information, except that furnished in formal proceedings, shall be furnished in the form of an amendment to the original petition. Each amendment (including those made on the petitioner's own initiative) should be consecutively numbered, and shall comply with the requirements of this regulation as to form, number of copies, manner of execution, verification, and all other essential respects. In the event that any petition shall be amended, the amendment shall contain a statement that a copy thereof has been served on the Postmaster General by sending the same to him by registered mail, postpaid, prior to the filing with the Board of such amendment.

§ 234.4 *Formal requirements.* Every petition shall be made on paper approximately 8½ by 13 inches in size except that exhibits or other documents attached thereto may be folded to those dimensions. Every petition shall be typewritten, printed, or reproduced by some other process which will produce a clear and durable result on firm, tough paper. Each copy must be clear and legible in all respects. A margin of at least 1 inch in width shall be left on the left-hand side of all pages, and all petitions must be bound on that side. All pages of a petition shall be consecutively numbered and the petition shall clearly describe and identify each exhibit by a separate number or symbol. All exhibits shall be deemed to constitute a part of the petition to which they are attached.

§ 234.5 *Time of filing.* A petition shall be deemed to have been filed only when it is actually received by the Board at its office in Washington, D. C.

§ 234.6 *Contents of petitions.* The petition should, in accordance with the provision of section 406 (c) of the act, include a statement of the rate the petitioner believes to be fair and reasonable. In this connection, the rate-making elements set forth in section 406 (b) of the act should be particularly considered by the petitioner in the preparation of the petition. Opportunity for argument will be given at the public hearing.

§ 234.7 *Service on Postmaster General.* The petition shall contain a statement that the petitioner has served a copy of the petition on the Postmaster General by sending the same to him by registered mail, postpaid, prior to the filing of the petition with the Board. The petition need not be accompanied by any further proof of service, but, upon setting any petition down for public hearing, the Board will cause notice of such hearing to be given to such interested parties as it deems appropriate in the particular case.

Accounts, Records and Reports

PART 241—FILING OF REPORTS BY CERTIFICATED AIR CARRIERS

AUTHORITY: §§ 241.1 and 241.2 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 407, 52 Stat. 1000, 49 U. S. C. 487.

SOURCE: §§ 241.1 and 241.2 appear at 14 F. R. 3538.

§ 241.1 *Reports of financial and operating statistics.* Each air carrier holding a certificate of public convenience and necessity shall make periodic financial and statistical reports to the Board using the appropriate schedules of the Report of Financial and Operating Statistics for Air Carriers, CAB Form 41; Interim Operating Statement and Selected Expenses, CAB Form 41 (a), and such amendments thereto as may hereafter be approved by the Board. Such reports shall be made in accordance with, and shall be filed with the Secretary of the Board at times specified by the reporting procedure contained in the Uniform System of Accounts for Air Carriers, effective January 1, 1947, and such amendments thereto as may hereafter be approved by the Board.

§ 241.2 *Uniform system of accounts.* Each air carrier engaged in scheduled air transportation shall keep its accounts, records, and memoranda in accordance with the Uniform System of Accounts for Air Carriers issued by the Civil Aeronautics Board, dated January 1, 1947, and such amendments thereto as may hereafter be prescribed by the Board.

PART 242—FILING OF REPORTS BY IRREGULAR AIR CARRIERS AND NONCERTIFICATED CARGO CARRIERS

AUTHORITY: §§ 242.1 to 242.5 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 407, 52 Stat. 1000, 49 U. S. C. 487.

SOURCE: §§ 242.1 to 242.5 appear at 14 F. R. 3538.

§ 242.1 *Statistical and flight reports required.* Statistical reports shall be filed with the Board by each small irregular carrier [1] in accordance with § 242.2, and by each large irregular carrier and noncertificated cargo carrier in accordance with § 242.3. Flight reports shall be filed with the Board by each large irregular carrier in accordance with sub § 242.4 and by each noncertificated cargo carrier in accordance with § 242.5. Each small irregular carrier, large irregular carrier, and noncertificated cargo carrier shall keep all accounts, records, and memorandums (including the accounts, records, and memorandums of the movement of traffic, as well as of the receipts and expenditures of money), which are needed in order to accomplish full compliance with the reporting requirements of this part. Such accounts, records, and memorandums as relate to statistical reports shall be preserved for 3 years, and such as relate to flight reports shall be preserved for 1 year. The reports to be filed by such carriers shall be pre-

[1] Section 2912 of this subchapter provides, as to the aircraft units utilized in the transportation services of an irregular air carrier; that, if "the allowable gross take-off weight exceeds 10,000 pounds for any one unit or 25,000 pounds for the total of such units (disregarding units of 6,000 pounds or less), such carrier shall be classified as a 'large irregular carrier', otherwise, such carrier shall be classified as a 'small irregular carrier'."

pared in accordance with the following provisions and shall be certified to be correct by a responsible officer of the reporting carriers.

§ 242.2 *Statistical reports by small irregular carriers.* (a) For the calendar year 1947 and thereafter for each succeeding calendar year, each small irregular carrier shall file a statistical report. Such report for the year 1947 shall be filed not later than July 15, 1948; and thereafter such report shall be filed within 45 days after termination of the reporting period.

(b) The statistical report shall contain the following data:

(1) *Balance sheet or statement of investment.* At end of reporting period.

(2) *Profit and loss statement.* Insofar as practicable, distinguish items attributable to transportation operations from items attributable to other operations; e. g., plane rentals, flying schools, airport services, etc.

(3) *Airplanes utilized.* Tabulation showing aircraft registration number, type, cost, date of acquisition, and the amount of accrued depreciation for each airplane owned as of the end of the reporting period.

(4) *Personnel.* For the payroll period ending nearest the middle of the last month of the reporting period, specify the number of personnel engaged in transportation operations, the number engaged in other operations, and the total.

(5) *Transportation of passengers or cargo.* (i) Revenue aircraft hours and miles.

(ii) Number of revenue passengers and tons of revenue cargo.

(iii) Revenue passenger-miles and revenue ton-miles of cargo.

§ 242.3 *Statistical reports by large irregular carriers and noncertificated cargo carriers.* (a) For the calendar year 1947, and thereafter for the calendar quarter ending March 31, 1948, and for each succeeding calendar quarter, each large irregular carrier and each noncertificated cargo carrier shall file a statistical report. Such reports for the year 1947 and for the first quarter of 1948 shall be filed not later than July 15, 1948, and thereafter, such report shall be filed within 45 days after termination of the reporting period.

(b) Such report shall contain the following data:

(1) *Balance sheet.* As of end of reporting period.

(2) *Profit and loss statement.* Insofar as practicable, distinguish items attributable to transportation operations from items attributable to other operations.

(3) *Airplanes utilized.* Tabulations showing type, aircraft registration number, and date acquired, for each airplane owned or rented as of the end of the reporting period, and indicating whether or not such airplane is utilized in transportation operations. For each airplane owned, such tabulation shall specify the cost thereof and the amount of accrued depreciation. For each airplane rented, such tabulation shall specify the amount of the rental. If data for a particular quarter are the same as those submitted for the previous quarter, a statement to that effect will suffice.

(4) *Personnel.* For the payroll period ending nearest the middle of the last month of the reporting period, set forth data as follows:

(i) The number of flight personnel engaged in transportation and the number of other activities, such as flight training.

(ii) The number of ground personnel engaged in transportation and the number in other activities.

(iii) The total number of personnel.

(5) *Transportation.* For the following data, distinguish between operations which were, and operations which were not, performed under letter of registration:

(i) Revenue aircraft hours and miles, and total aircraft hours and miles.

(ii) Number of revenue passengers and tons of revenue cargo.

(iii) Revenue passenger-miles and revenue ton-miles of cargo.

(6) *Station data.* Reports by noncertificated cargo carriers shall contain also the following information, covering only operations performed pursuant to letter of registration, and set forth by points so authorized to be served:

(i) The number of flights arriving at and departing from each station during the period covered.

(ii) The total tons of cargo enplaned and deplaned at each station during the period covered.

§ 242.4 *Flight reports by large irregular carriers.* (a) Commencing with a report for the second calendar quarter of 1948, the 3 months' period ending June 30, 1948, each large irregular air carrier shall file a flight report for each calendar quarter within 20 days after the termination of the reporting period. Data reported pursuant to paragraph (b) (1) and (b) (3) of this section shall be available for official use on behalf of the Civil Aeronautical Board, but shall otherwise be withheld from public disclosure except as disclosure may be necessary in carrying out responsibilities under section 412 of the act.

(b) Requirements for flight report are as follows:

(1) *Chronological tabulation.* The flight report shall contain a tabulation of all flights other than training and test flights on which no goods or passengers are carried, in chronological order, setting forth the following data for each such flight:

(i) Registration number of the aircraft.

(ii) An indication by the letters "D", "P", "C", or "PC" whether the flight was "deadhead" or carried "passengers," or "cargo," or both "passengers and cargo."

(iii) The date of departure from the point of origin and from all points at which passengers or cargo were enplaned or deplaned, and the terminal point. List such points in the order served.

(2) *Agreements and manifests.* The flight report shall include memorandums of all oral agreements, copies of all written agreements, and copies of all passenger and cargo manifests covering flights of the following categories:

(i) Each flight on which persons, either revenue or nonrevenue (other than crew required by applicable Civil Air Regulations), were carried between a point in the United States (as defined by section 1 (32) of the Civil Aeronautics Act) and a point outside thereof.

(ii) Each flight which, in the opinion of the carrier, was not in common carriage.

(3) *Other data.* For each flight of the categories designated by subparagraph (2) of this paragraph, a tabulation of the following data shall be submitted (unless the information is available from instruments filed pursuant to said item);

(i) Name and address of the person for whom the flight was operated.

(ii) Manner in which passengers and cargo transported on such flight were obtained (solicitation, advertising, circular, etc.)

(iii) Nature, terms, and conditions of the arrangements for such flight.

(iv) Obligations and responsibilities of the parties to the arrangement in connection with the transportation.

(v) Number of persons (other than crew required by applicable Civil Air Regulations) carried on each flight of the category designated by subdivision (i) of this subparagraph.

(4) *Agreements with agencies, etc.* The flight report shall state whether or not any passengers or cargo were transported pursuant to arrangements made with any traffic generating agencies (such as ticket agents, travel agents, travel bureaus, forwarders, consolidators, etc.), and shall include memorandums of all oral agreements and copies of all written agreements covering any such arrangements. For each such arrangement, a tabulation of the following data shall be submitted (unless the information is available from the instruments filed):

(i) Name and address of the agency party to the arrangement.

(ii) Nature, terms, and conditions of the arrangement, including basis on which agency compensation is computed.

(iii) Obligations and responsibilities of the parties in connection with the transportation.

(iv) Statement as to whether or not there was any expressed or implied agreement as to number of flights to be operated or amount of space to be made available.

§ 242.5 *Flight reports by noncertificated cargo carriers.* (a) For the calendar quarter ending March 31, 1948, each noncertificated cargo carrier shall file a flight report by July 15, 1948, and for each succeeding calendar quarter shall file such report within 20 days after the termination of the respective reporting period. Data reported pursuant to this section shall be available for official use on behalf of the Civil Aeronautics Board, but shall otherwise be withheld from public disclosure unless reportable pursuant to section 412 of the act.

(b) Requirements for the flight report are as follows:

(1) *Agreements and manifests.* The flight report shall state whether or not any flights of the following categories were operated, and shall include memorandums of all oral agreements, copies of all written agreements, and copies

of all passenger and cargo manifests covering any such flights:

(i) All flights on which persons, either revenue or nonrevenue (other than crew required by applicable Civil Air Regulations) were carried.

(ii) All flights to or from any point not authorized to be served by the carrier pursuant to Part 295 of this subchapter.

(2) *Other data.* For each flight of the categories designated by subparagraph (1) of this paragraph a tabulation of the following data shall be submitted (unless the information is available from instruments filed pursuant to said subparagraph):

(i) Name and address of the person for whom the flight was operated.

(ii) Manner in which passengers and cargo transported on such flight were obtained (solicitation, advertising, circular, etc.)

(iii) Nature, terms, and conditions of the arrangements for such flight.

(iv) Obligations and responsibilities of the parties to the arrangement in connection with the transportation.

(v) Number of revenue and nonrevenue passengers and pounds of cargo transported on each flight of the category designated by subparagraph (1) (ii) of this paragraph.

PART 243—FILING OF REPORTS BY ALASKAN AIR CARRIERS

Sec.
243.1 Statistical report required.
243.2 Place of filing.
243.3 Public disclosure withheld.

AUTHORITY: §§ 243.1 to 243.3 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 407, 52 Stat. 1000, 49 U. S. C. 487.

SOURCE: §§ 243.1 to 243.3 appear at 14 F. R. 3539.

§ 243.1 *Statistical report required.* Each Alaskan air carrier which does not hold a certificate of public convenience and necessity, each Alaskan air carrier holding a certificate of public convenience and necessity but relieved from complying with the requirements of § 241.1 of this chapter and each Alaskan pilot-owner (as defined in § 292.8 of this chapter) shall make periodic financial and operating statistical reports to the Board for all periods subsequent to June 30, 1948, using the appropriate schedules of the Report of Financial and Operating Statistics (Alaska), CAB Form 2790 and such amendments thereto as may be approved hereafter by the Board.

§ 243.2 *Place of filing.* The reports required by § 241.1 of this chapter with respect to Alaskan Air Carriers holding certificates of public convenience and necessity, and by § 243.1 shall be filed with the Director of the Alaska Office, at Anchorage, Alaska, at such times as may be specified by the Director and shall be made in accordance with the instructions of the Director relating thereto.

§ 243.3 *Public disclosure withheld.* Data reported by individual Alaskan pilot-owners pursuant to § 243.1 shall be available for official use on behalf of the Board, but shall otherwise be withheld from public disclosure except as disclosure may be necessary in connection with use of such data in formal proceedings of the Board.

PART 244—FILING OF REPORTS BY AIR FREIGHT FORWARDERS

Sec.
244.1 Statistical report required.
244.2 Insurance statements.

AUTHORITY: §§ 244.1 and 244.2 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 407, 52 Stat. 1000, 49 U. S. C. 487.

SOURCE: §§ 244.1 and 244.2 appear at 14 F. R. 3540.

§ 244.1 *Statistical report required.* (a) Air freight forwarders operating during any portion of the quarter ending December 31, 1948, and subsequent to the filing of applications for letters of registration shall file a statistical report on or before January 31, 1949, in the form and manner herein prescribed. Thereafter, air freight forwarders holding letters of registration, whether or not actually engaged in air-freight-forwarder operations, shall file statistical reports for each succeeding calendar quarter. Such report shall be filed within 30 days after the termination of each calendar quarter and shall be certified to be correct by a responsible officer of the reporting air freight forwarder.

(b) Such statistical report shall contain the following data:

(1) Balance sheet, prepared in accordance with accepted practices.

(2) Profit and loss statement, with a separation of expense items so as to indicate payments to direct air carriers.

(3) Statistical data:

(i) Number of shipments received from shippers for carriage by air.

(ii) Number of consignments to carriers by air.

(iii) Number of tons consigned for shipment by:

Certificated air carriers.
Noncertificated cargo carriers.
Irregular carriers.
Surface carriers (rail, motor other than pick-up and delivery or water).

(4) Station data (list by individual stations):

(i) Number of personnel engaged in:

Selling.
Operating.
Administrative and other.

(ii) Total number of tons received from shippers for carriage by air.

§ 244.2 *Insurance statements.* With each statistical report each air freight forwarder shall submit a statement of all outstanding cargo and public liability insurance in effect or surety bonds with regard to its operations pursuant to Part 296 of this chapter. Such statement shall identify the companies issuing the policies or bonds, the amounts thereof and a brief statement as to their coverage.

PART 245—REPORTS OF OWNERSHIP OF STOCK AND OTHER INTERESTS

Sec.
245.1 Reports required.
245.2 Time for reporting.
245.3 Schedule of data.

AUTHORITY: §§ 245.1 to 245.3 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 407, 52 Stat. 1000, 49 U. S. C. 487.

SOURCE: §§ 245.1 to 245.3 appear at 14 F. R. 3540.

§ 245.1 *Reports required.* At the times and in the manner hereinafter provided, each officer and each director of each air carrier shall transmit to the Board a report describing the shares of stock or other interests held by him in any air carrier, any person engaged in any phase of aeronautics, or any common carrier, and in any person whose principal business, in purpose or in fact, is the holding of stock in, or control of, air carriers, other persons engaged in any phase of aeronautics, or common carriers.

§ 245.2 *Time for reporting.* Not more than 30 days after such officer or director is first elected or appointed, a report shall be filed covering the period from January 1 of the preceding year to the date of election or appointment; subsequently, a report shall be filed, on or before March 1 of each year, covering such portion of the preceding calendar year as has not been previously reported, or the full year if he so desires.

§ 245.3 *Schedule of data.* The report required in § 245.1 shall be prepared in accordance with the following schedule:

SCHEDULE

I. Data as to individual reporting. The categories for which data shall be set forth are as follows:

(1) Name.
(2) Address.
(3) Principal occupation.
(4) All air carrier positions held (indicate title of position and name of air carrier);
(5) Positions held as officer, director, or member of:
(a) Common carriers (other than air);
(b) Enterprises engaged in any other phases of aeronautics;
(c) Enterprises whose principal business is that of holding securities and or control of air carriers, common carriers, and enterprises which are engaged in any other phases of aeronautics (giving title of position and name of company or enterprise);
(6) Append the following declaration to the report:

"I hereby declare that this report, including documents attached hereto, has been examined by me, and to the best of my knowledge and belief is a true, correct, and complete report, made in good faith, for the period stated." Execute the declaration, affixing date and signature.

II. Data as to stock or other interests. The categories for which data shall be set forth are as follows:

(1) Interests held in air carriers;
(2) Interests held in other common carriers;
(3) Interests held in any enterprise engaged in any phase of aeronautics other than air carriers;
(4) Interests held in enterprises whose principal business is that of holding securities and or control of air carriers, other common carriers, or enterprises which are engaged in any phase of aeronautics other than air carrier. For each of the foregoing categories, the following data shall be set forth:

A. Name of enterprise (corporate or otherwise) in which interest is or was held at any time during the period covered by report.

B. Class of interest, such as common stock, preferred stock, rights, options, etc.; and description of bonds, notes, or other instruments evidencing interest or ownership.

(Give names and addresses of all persons (1) by whom any part of the foregoing items were held for reporting individual, (2) for whom any part of the foregoing items were held by reporting individual, (3) who held joint interest with reporting individual in any part of the foregoing items, and state nature of the relationship and the principal business of such persons.)

C. Number of shares or amount of each item reported under "B" held as of the last day of the period covered by report.

D. On all items reported under "C" which equal 5 percent or more of the total outstanding amount of the same class, show such percentages.

E. Indicate by "Yes" or "No," whether reporting individual controlled and/or exercised ALL voting rights of the items reported under "B." If the answer is "No," state amount of voting rights not controlled or exercised by reporting individual and give the names, addresses, and principal business of persons controlling and/or exercising such voting rights.

F. Maximum amount held during period covered by report.

G. On all items reported under "F" which equal 5 percent or more of the total outstanding total amount of the same class show such percentages.

H. Minimum amount held during period covered by report.

PART 246—REPORTS OF STOCK OWNERSHIP OF AFFILIATES OF AIR CARRIERS

AUTHORITY: §§ 246.1 to 246.3 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 407, 52 Stat. 1000, 49 U. S. C. 487.

SOURCE: §§ 246.1 to 246.3 appear at 14 F. R. 3540.

§ 246.1 *Definition.* For the purposes of this part a person shall be deemed to be an affiliate of an air carrier if it has direct or indirect control over such air carrier, or if it has the power to exercise control over such air carrier.

§ 246.2 *Stock reports.* Except as provided in § 246.3, every affiliate of an air carrier shall submit on or before January 25 of each year:

(a) A report showing, as of the preceding December 31:

(1) The names and addresses of each of its stockholders or members holding more than 5 percent of the entire capital stock or capital, as the case may be, of such affiliate, together with the name and address of any person for whose account, if other than the holder, such stock is held;

(2) The number of shares, and percentage of the total shares issued, held by each such stockholder, and indicating whether such shares are voting, nonvoting, common, or preferred; and

(b) A report setting forth, as of the preceding December 31, a description of the shares of stock or other interests held by the affiliate, or for its account, in any common carrier, air carrier, foreign air carrier, or any person engaged in any phase of aeronautics, and a description of the shares of stock or other interests held by the affiliate or for its account in any person whose principal business, in purpose or in fact, is the holding of stock in, or control of, common carriers, air carriers, foreign air carriers, or persons engaged in any phase of aeronautics, indicating:

(1) The name of the issuing company;

(2) Whether such stock or other interest is voting, nonvoting, common or preferred, convertible or nonconvertible. (If convertible an explanation of the option shall be set forth.)

(3) The par and book value of such stock or other interests held by the affiliate or for its account, and the amount pledged, unpledged, and held in fund and deposit accounts, and

(4) The total amount of stock or other interests (by class and issue) having voting or conversion rights which have been actually issued by the issuing company and are outstanding (whether or not held by the affiliate reporting hereunder). If convertible, an explanation of the option shall be set forth, and the total amount convertible shall be stated.

§ 246.3 *Exceptions.* The reports required in § 246.2 need not be filed as of December 31 of any year by any such affiliate:

(1) If such affiliate is an air carrier required to file a report as of December 31 of the same year, pursuant to section 407 (b) of the act; or

(2) If such affiliate is an individual required to file a report as an officer or director of any air carrier, on or before March 1 of the following year, pursuant to section 407 (c) of the act: *Provided, however,* That if between said December 31 and March 1 of the following year any such individual should be relieved of the requirement of filing said report as an officer or director of any air carrier, then the exception herein created shall immediately terminate as to said individual, and said individual shall file, on or before April 1, the report required in § 246.2 (b).

PART 247—DIRECT AIRPORT-TO-AIRPORT MILEAGE RECORDS

§ 247.1 *Official mileage record of the Board.* The direct airport-to-airport mileage record now maintained, and as hereafter amended or revised from time to time by the Tariffs and Service Division of the Bureau of Economic Regulation of the Civil Aeronautics Board in the regular performance of its duties, is hereby adopted as the official mileage record of the Board and the mileages set forth therein shall be used in all instances where it shall be necessary to determine direct airport-to-airport mileages pursuant to the provisions of Titles IV and X of the Civil Aeronautics Act of 1938, as amended or any rule, regulation, or order of the Board pursuant thereto. (Sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interprets or applies sec. 407, 52 Stat. 1000, 49 U. S. C. 487) [14 F. R. 3541]

PART 248—SUBMISSION OF AUDIT REPORTS BY PUBLIC ACCOUNTANTS

AUTHORITY: §§ 248.1 and 248.2 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 407, 52 Stat. 1000, 49 U. S. C. 487.

SOURCE: §§ 248.1 and 248.2 appear at 14 F. R. 3541.

§ 248.1 *Filing of audit reports.* Whenever any air carrier shall have caused an annual audit of its books, records, and accounts to be made by public accountants, such air carrier shall file with the Board a special report consisting of a true and complete copy of the audit report submitted by public accountants, including all schedules, exhibits, and certifications included in or attached to such report. Such a report shall be filed in duplicate with the Board within 15 days after the public accountants have submitted their reports to the air carriers, except that no such special report is required to be filed until 30 days after the effective date of this regulation. This section shall apply to all annual audit reports which may have been submitted to any air carrier on or after January 1, 1944.

§ 248.2 *Withholding from public disclosure.* The special report required to be filed by § 248.1 shall be withheld from public disclosure, until further order of the Board, if such treatment is requested by the air carrier at the time of filing.

PART 249—PRESERVATION OF ACCOUNTS, RECORDS AND MEMORANDA

AUTHORITY: §§ 249.1 to 249.6 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 407, 52 Stat. 1000, 49 U. S. C. 487.

SOURCE: §§ 249.1 to 249.6 appear at 14 F. R. 3541.

§ 249.1 *Definitions.* For the purposes of this part:

(a) "Records" means air carrier records which belong to the categories set forth in § 249.4. The term "records" embraces accounts and memorandums and includes material coming into the possession of an air carrier through acquisition of, or merger with, other air carriers.

(b) "Certified description" means an instrument identifying records by date or period covered and describing them in accordance with § 249.4, which instrument has been pronounced correct in a certificate executed by a responsible officer of an air carrier.

(c) "Certified reproduction" means a photographic reproduction of records, which has been pronounced correct in a certificate executed by a responsible officer of an air carrier, after having been made pursuant to an authorization issued by the Director of the Bureau of Economic Regulation of the Board (1) by circulating, to all air carriers, a communication authorizing the substitution of a photographic reproduction for specified categories of records, or (2) by approving an "application for substitution" filed with him by an air carrier.

(d) "Application for substitution" means an application setting forth: (1)

A "certified description" of records relating to a period for which the Board has completed its audit; (2) a description of the photographic process proposed for reproducing such records; (3) a request for approval of the substitution of such reproduction for such records.

§ 249.2 *Use of certified reproductions.* An air carrier may substitute a "certified reproduction" for the records reproduced.

§ 249.3 *Preservation of certified reproductions.* All records, and all "certified reproductions" which have been substituted for records, shall be preserved by each air carrier for the respective periods prescribed in § 249.4. Upon the execution of a "certified description," records which have been replaced by a "certified reproduction" and records and "certified reproductions" which have been preserved for the prescribed period, may be destroyed, if further preservation is not necessitated by the requirements of any governmental instrumentality. If, during the prescribed period of preservation, records shall become unavailable through loss, destruction, or otherwise, the air carrier shall, without delay, submit to the Board an explanatory statement and a "certified description" of such records.

§ 249.4 *Time for preservation of records.*

PERIODS OF TIME PRESCRIBED FOR THE PRESERVATION OF RESPECTIVE CATEGORIES OF AIR CARRIER RECORDS

Item Nos.

1–18	Administrative and financial.
19	Insurance coverage and claim records.
20–23	Revenues.
24–32	Expenditures.
33–37	Maintenance and overhaul.
38–41	Transportation.
42–46	Passenger service and reservations.
47–56	Miscellaneous.

ADMINISTRATIVE AND FINANCIAL

1. Minute books of directors', stockholders' and other committee meetings: Permanently.
2. Capital stock and bond records: Permanently.
3. Corporate election records, including (A) Official list of voting stockholders, (B) Returned proxies: 1 year after expiration of term.
4. Annual and interim reports to stockholders: Permanently.
5. Monthly or other periodical statements and supporting work papers of general balance sheet, income and profit and loss accounts, comparative or otherwise: 5 years.
6. Retired securities: 3 years.
7. Ledgers or ledger accounts:

A. Permanent: (1) General: (2) Investments and Securities; (3) Property and Equipment; (4) Revenue and Expense: Permanently.

B. Others:

(1) Materials and supplies: 6 years.

(2) Bank balances: 3 years.

(3) Expense and working fund advances: 1 year.

(4) Accounts receivable. General: 6 years.

(5) Accounts payable. General: 6 years.

(6) Accounts receivable. Traffic: 2 years.

(7) Accounts payable. Traffic: 2 years.

8. Journals and registers supporting ledger entries: 10 years.

A. Journals (including authorizations, work sheets, or summaries needed to explain journal entries); (1) Journal vouchers (general); (2) Cash receipts; (3) Cash disbursements.

B. Registers: (1) Voucher, (2) Check, (3) Insurance, (4) Deferred charges, (5) Sales, (6) Payroll, (7) Tax.

9. Deeds and franchises: Permanently.
10. Title papers: Until disposition of property or equipment.
11. Contracts, agreements, releases:

A. Contracts:

(1) Involving an interest in realty: Permanently.

(2) With governmental bodies (major contracts): Permanently.

(3) Involving purchase or sale of equipment: 6 years.

(4) Leases: 6 years after termination.

(5) Of agency: 3 years after termination.

(6) Air Travel Plan (including requests for additional cards): 3 years after termination.

(7) Miscellaneous: Until expiration.

B. Releases from direct or contingent liability arising out of actions in tort: 2 years.

12. Tax records:

A. Ad Valorem (according to value):

(1) Real estate (Statements, receipts, and assessment appeals): 2 years after disposition of property.

(2) Personal property (Statements, receipts, reports, and assessment appeals): 10 years.

B. Privilege taxes—statements, receipts, returns or reports, supporting summaries, and assessment appeals (franchise, capital stock, licenses): Permanently.

C. Excise taxes on manufacture, sale or consumption (transportation, sales, gasoline and oil):

(1) Statements, receipts, returns or reports, report summaries and assessment appeals: 10 years.

(2) Details, supporting report summaries: 4 years.

D. Social Security taxes:

(1) State and Federal unemployment insurance:

(a) Receipts; returns or reports; report summaries; assessment appeals: 10 years.

(b) Details supporting report summaries; removal notice forms: 3 years.

(2) Federal old age benefits:

(a) Receipts; returns or reports; report summaries; assessment appeals; Permanently.

(b) Details supporting report summaries: First quarterly returns each year, permanently; other quarterly returns, 10 years.

E. Income:

(1) Federal, State and municipal income tax returns. Information returns, supporting papers, receipts, papers supporting refunds or legal actions relating to income taxes: Permanently.

(2) Detail supporting forms to Federal, State and municipal information returns: 3 years.

13. Fidelity bonds of employees:

A. Individual bonds: 3 years after termination of employment.

B. Blanket bonds: 3 years after expiration of bond.

14. Bulletins, orders, regulations, and other communications from Federal and State regulatory bodies pertaining to the air carrier: 1 year after becoming ineffective or inapplicable.

15. Treasurer's records:

A. Statements and summaries of balances on hand and with depositories or other periodical statements of working cash balances: 1 year.

B. Statements from depositories of funds received, disbursed, and transferred: 3 years.

C. Authorities for transfer of funds from one depository to another: 1 year after expiration.

D. Daily or other periodical statements of the receipts and disbursements of funds: 1 year.

E. Bank deposit books and check book stubs: 3 months after bank reconciliation.

F. Slips or statements giving the postings of miscellaneous receipts and payments of funds when the information contained thereon is shown on other records which are retained: 3 years.

G. Copies of deposit slips and advices of transfer from one depository to another: 3 months after bank reconciliation.

16. Audit reports:

A. Reports, examinations, and audits prepared and certified by independent public accounts: Permanently.

B. Reports of examinations and audits by internal auditors and others: 3 years.

17. Records pertaining to verifications of treasurers' cash or securities: 3 years.

18. Patents and copyright records:

A. Records pertaining to applications on which patents or copyrights issued: Permanently.

B. Records pertaining to applications on which patents or copyrights did not issue: 3 years after abandonment or final rejection.

INSURANCE COVERAGE AND CLAIM RECORDS

19. Insurance coverage and claim records:

A. Insurance: (1) Policies; (2) underwriters' inspection reports of condition of property: until expiration of policy.

B. Claim files including memoranda and reports in connection with loss, damage, personal injury, fire, etc., except claims for refund of transportation charges: 6 years after settlement or rejection.

C. Assignments, attachments, and garnishments involving (1) employees' salaries or (2) direct liability of carrier: 3 years.

REVENUES

20. Sales and ticket reports and other similar reports from stations, offices and agents: 4 years.

21. Tickets and ticket records:

A. Audited ticket coupons: 2 years.

B. Perpetual inventory ticket stock: 3 years.

C. Requisitions and receipts for tickets furnished agents and ticket-selling employees: 3 years.

D. Records and reports incident to ticket refund claims: 3 years.

E. Lost ticket memoranda, certification of loss and receipt for refund: 3 years.

22. Volume travel plan records:

A. Receipts for air travel cards: 1 month after expiration or return of card.

B. Receipts for one-trip travel orders: 3 months after orders are accounted for.

23. Invoices, bills, accounts receivable statements: (A) transportation receipts and one trip travel orders; (B) copies of invoices and supporting papers; (C) credit memoranda; (D) statements (except when used as ledger): 1 year after settlement.

EXPENDITURES

24. Payroll and personnel records:

A. Pay records in general: (1) Control; (2) Individual employee earnings records; (3) Canceled checks or receipts for payment; (4) Pay roll authorization removal, adjustmen notices; (5) Pay roll certification; (6) Overtime certification; (7) Absent reports: 6 years.

B. Other records:

(1) Employees' payroll deduction authorization: 1 year after termination of authority.

(2) Clock cards and flight crews' time records: 3 years.

(3) Job expense distribution cards: 3 years.

(4) Records incident to issuance and control of identification badges and cards: 6 months after return of identification media.

C. Personnel records: (1) Applications, (2) contract or employment agreements, (3) bond record, (4) history: 2 years after termination of employment.

25. Vouchers:

A. File of voucher jackets or other (alphabetical, etc.) indexes to vouchers: 3 years.

B. File of voucher jackets with supporting papers attached:

(1) Vouchers involving purchase of property and/or equipment having unit values of $100.00 or more: permanently.

(2) Vouchers involving payments of workmen's compensation insurance: 10 years.

(3) Other vouchers: 6 years.

C. Paid drafts, checks and receipts for cash paid out except as otherwise herein provided: 6 years.

26. Other equipment and property records:

A. Schedule of budget authorization for retirements: permanently.

B. Approved authorization for retirements: permanently.

C. Depreciation schedules: permanently.

27. Special authorization for expenditures:

A. Equipment and property: permanently.

B. Other: 3 years.

28. Periodical schedules or statements of material and supplies received, issued, and on hand by locations: 3 years.

29. Materials and supplies, physical inventory data:

A. Records of inventories on hand: 3 years.

B. Reconciliation of physical inventory with book balances by account classification: 3 years.

C. Detail inventory cards supporting records of inventories on hand: 1 year.

30. Stores record of materials received: 2 years.

31. Perpetual inventory records and sources of information from which journals for distribution of materials and supplies to expense are prepared:

A. Perpetual inventory cards showing receipts, issues, balances, etc.: 2 years after transfer.

B. Requisitions: 2 years.

C. Notices of stores issues and transfers: 2 years.

D. Stores bin cards: 3 months after discontinuance.

E. Notices of depleted stock: 3 months after replenishment.

F. Records and memoranda of consigned materials: 1 year after settlement.

32. Gasoline and oil: (A) requisitions (requests for issue; (B) notices of issues, transfers, etc.; (C) daily consumption records and motor readings; (D) periodical station summaries: 2 years.

MAINTENANCE AND OVERHAUL

33. Recommendations and approvals for repairs to property and equipment:

A. Log books: Until equipment is sold or 8 years after retirement.

B. Job or work orders: 2 years.

34. Records and reports concerning repairs (excluding job expense distribution detail):

A. Flight equipment:

(1) Maintenance work: (a) Line check and work-performed reports; (b) intermediate line engine check and work-performed reports: 2 years.

(2) Overhaul work: (a) Intermediate main base engine check and work-performed reports; (b) major overhaul check and work-performed reports: until equipment is sold or 3 years after retirement.

B. Ground equipment and property: 2 years.

35. Records of inspections made by public authorities:

A. Certificate of aircraft airworthiness: Until equipment is sold or 3 years after retirement.

B. Recurring inspections: 3 years after next inspection.

C. Other inspections: 3 years.

36. Flight equipment maintenance service schedule showing by type of equipment the units received, released, and on hand: 1 year.

37. Maintenance statistical data by individual units of flight equipment including: (A) accumulated flight time; (B) periodic inspections; (C) maintenance service work performed; (D) mechanical failures, etc.: until equipment is sold or 3 years after retirement.

TRANSPORTATION

38. System report of airplane movements by trip number showing: (A) arrivals; (B) departures; (C) delays; (D) related information: 6 years.

39. Individual trip reports:

A. Operations data: (1) dispatchers clearance forms; (2) weather forecasts (terminal and intermediate); (3) flight plan; (4) radio contacts by or with pilots enroute: 3 months.

B. Other data: (1) records of crews by trip numbers; (2) passenger and cargo manifests; (3) mail manifest, report of mail pouches received and distributed; (4) records and reports of irregularities and delays in handling of passengers, mail, and other cargo: 1 year.

40. Records and reports (internal) and memoranda incident to airplane accidents:

A. Major accidents: 6 years.

B. Minor accidents: 2 years.

41. Air express (records and reports of express received and delivered; delays and irregularities, waybills and related matters): 3 years.

PASSENGER SERVICE AND RESERVATIONS

42. Records of comments and complaints from passengers and others: 1 year.

43. Records and reports of lost and found department: 1 year.

44. Reports incident to meals prepared and served (for requisitions, notices of issue and commissary inventories, see No. 31): 1 year.

45. Reservations reports and records:

A. Cards and charts constituting original source of passengers' names, telephone numbers, etc.: 3 months.

B. Telegrams and radio messages relating to the clearance of space, passenger dispatches, etc.: 3 months.

C. Records and reports relating to errors or irregularities, oversales, no-show passengers, etc.: 1 year.

D. Bulletins of instructions dealing with schedule changes, reservations, procedure sales effort, etc.: 6 months after expiration.

46. Detective and police service reports and records in connection with policing the company's property, detective service, investigations of robberies, attempts to defraud the company: 1 year.

MISCELLANEOUS

47. Purchase records:

A. Purchase orders: 3 years.

B. Requisitions for purchase orders: 1 year.

48. Tariff and other rate authorities:

A. Official tariff regulations and amendments thereto: permanently.

B. Authorizations, records, reports, and supporting papers incident to the transportation of persons at reduced rates or free: 6 years.

C. Correspondence (including bulletins and circulars) and working papers in connection with the making of rates and compilation and interpretation of tariffs: 1 year after cancellation of tariff.

49. Reports to Civil Aeronautics Board, its predecessor (the Civil Aeronautics Authority), and other regulatory bodies:

A. Periodic financial, operating, and statistical reports and supporting papers: permanently.

B. Reports of accidents involving aircraft, mechanical interruption in flight, powerplant failure, and aircraft structural failure and defects; and supporting papers therfor: 2 years after current year.

C. Records and reports of petitions and hearings: 5 years.

50. Engineering records (maps, profiles, specifications; estimates of work; records of engineering studies; records pertaining to extensions, additions, and betterment projects):

A. Projects completed: 6 years after completion.

B. Projects abandoned: 3 years after abandonment.

51. Instructions to employees, agents and others (file copies of books and circulars of instruction on various topics): 2 years after expiration or cancellation.

52. Employees welfare records:

A. Medical:

(1) By individual employee: 2 years after termination of employment.

(2) Other: 1 year.

B. Retirement plan: 6 years after termination of employment or 3 years after notice of death of annuitant.

C. Workmen's compensation:

(1) Accident reports:

(a) Major: 10 years.

(b) Minor: 6 years.

(2) Payroll audits: 3 years.

D. Employees relief, hospital insurance, credit-union, other than records pertaining to the receipt and disbursement of funds: 1 year.

(1) Records pertaining to the receipt and disbursement of funds: same periods as provided for similar records elsewhere herein.

53. Advertising and publicity department records pertaining to displays, photographs, publicity, and advertising copy: 1 year.

54. Records and reports of damage to buildings and equipment not covered by insurance: 3 years.

55. Correspondence:

A. Correspondence (including interoffice memoranda) without which the records specified in provisions considered herein would not be complete: The period prescribed for primary records.

B. Other correspondence: 1 year.

56. Data relating to the destruction of records as provided in this section; authorizations and certificates executed in connection with the reproduction or destruction of records: Permanently.

§ 249.5 *Air freight forwarders.* All air freight forwarders as defined in § 296.1 of this chapter shall retain and preserve the following records and documents for a period of 1 year, unless otherwise ordered by the Board:

1. Shipping documents—airway bills, bills of lading, cargo manifests, receipts, exchange orders, invoices, and similar evidences of shipping transactions;

2. Information to agents and representatives—bulletins, circulars and all instructions to traffic-soliciting personnel;

3. Information to the public—press releases, paid advertisements, pamphlets, brochures, circulars, and bulletins;

4. Agreements—agreements, contracts, documents, and memorandums evidencing any arrangement with agents and representatives, with direct air carriers, with other freight forwarders, or with agents and representatives thereof;

5. Correspondence—all correspondence relating to any of the foregoing.

§ 249.6 *Air freight forwarders; administrative and financial records.* All air freight forwarders shall retain their administrative and financial records and insurance and claim records as specified and referred to in § 249.4 for the periods indicated therein.

Prohibited Interests

PART 251—PROHIBITED INTERESTS; INTERLOCKING RELATIONSHIPS

AUTHORITY: §§ 251.1 to 251.13 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 409, 52 Stat. 1002, 49 U. S. C. 489.

SOURCE: §§ 251.1 to 251.13 appear at 14 F. R. 3543.

§ 251.1 *Application for approval.* If approval by the Board is desired of an interlocking relationship which would otherwise be prohibited by section 409 (a) of the act (hereinafter in this part referred to as an "interlocking relationship"), an application for such approval shall be filed with the Board by the individual (hereinafter in this part referred to as the "individual applicant") occupying or seeking to occupy the interlocking relationship, and by each air carrier (hereinafter in this part referred to as the "air carrier applicant") in which such individual holds or seeks to hold the position of officer or director. At their election such applicants may join in a single application. If separate applications are submitted it is desirable that all shall be filed at the same time. An application may incorporate by specific reference current information contained in another application in the same matter or in any document then on file with the Board.

§ 251.2 *Formal requirements of applications.* Applications filed pursuant to this part shall conform generally to the outline set forth in § 251.3 and to the requirements of § 302.3 of this chapter, with the additional requirement that each individual verifying the application shall include in his verification a statement that he has personally made a careful investigation of the proposed interlocking relationship and that the application includes all of the information required by this part and that it contains no misleading statement and does not omit information which would tend to show that the public interest would be adversely affected by the existence of the proposed interlocking relationship. If a joint application is filed it shall be verified by the individual applicant and by a responsible officer of each air-carrier applicant. However, any individual verifying any such joint application may disclaim responsibility for any statements therein except statements concerning matters which are peculiarly within his knowledge. In any such case, however, every allegation contained in the application shall be verified by one or more qualified individuals.

§ 251.3 *General provisions concerning contents of applications.* (a) Each application (except one filed pursuant to § 251.4 shall, among other things, include the following information:

(1) The full name, place of residence, and citizenship of the individual applicant;

(2) The name and address of the major business or professional activity of the individual applicant;

(3) A complete description of the interlocking relationship for which approval is sought, as well as a description of any other interlocking relationship occupied by the individual applicant which has been approved by the Board. (This description shall include the date and manner of the individual applicant's election or appointment to the position or positions which he occupies or seeks to occupy, and shall state the name or names of the persons primarily responsible, directly or indirectly, for his election or appointment. It shall also include a statement of his present or contemplated duties in connection with the interlocking relationship for which approval is sought and the approximate amount of time devoted or expected to be devoted thereto);

(4) The name of the person or persons, if any, whom the individual applicant represents or will represent on the board of directors of each air carrier applicant, together with a statement as to any financial interest held by such person or persons in any air carrier, common carrier, person engaged in any phase of aeronautics otherwise than as an air carrier, or person whose principal business, in purpose or in fact, is the holding of stock in, or control of any other person engaged in any phase of aeronautics;

(5) The name and address of each business (including but not limited to corporations, partnerships, trusts, etc.) of which the individual applicant is an officer, director, partner, trustee, receiver, manager, attorney, agent, or controlling stockholder or employee, the general character of each such business and a description of the individual applicant's financial interest therein;

(6) A complete description of any benefit and of the amount of, and basis for, any money or thing of value (i) received by the individual applicant during the last year from each air carrier applicant and from any person with whom the individual applicant has or seeks to have an interlocking relationship, whether for services, reimbursement of expenses or otherwise, and (ii) which the applicant contemplates receiving from any such person during the continuance of the interlocking relationship;

(7) The names and titles of all officers and directors of each air carrier applicant, and of each person with whom the individual applicant has or seeks to have an interlocking relationship;

(8) With respect to the individual applicant, a statement that the information contained in the most recent report filed by him with the Board pursuant to Part 245 of this chapter is the same as of the date within 30 days of the filing of the application pursuant to this regulation, or, if such information has changed, a statement setting forth the details of such changes; and with respect to each officer and director of each air carrier applicant other than the individual applicant, a statement that there is presently on file with the Board a report pursuant to Part 245 of this chapter for each such individual officer or director (If no such report is on file with reference to any such officer or director, including the individual applicant, it shall be filed concurrently with the application pursuant to this part);

(9) The names (i) of the largest stockholders, not exceeding 20, who hold 1 percent or more of the voting capital stock of any air carrier applicant and (ii) of the largest stockholders, not exceeding 20, who hold 1 percent or more of the voting capital stock of any person with whom an interlocking relationship is sought by such application to be approved; together with the number of shares of each class of stock held by each of such stockholders and the percentage which such shares bear to the total number of shares of the same class authorized and outstanding, (If all or any part of such shares are held for the account of any person other than the holder, the names of such persons shall be disclosed. If the applicant, after making all reasonable efforts, is unable to obtain disclosure of such information with respect to any of the persons classified under (ii) in the first sentence of this paragraph, the application shall state specifically the efforts made to obtain such information and the reasons why such efforts were unsuccessful);

(10) A description of the shares of stock or other interests held by each air carrier applicant or for its account in persons other than itself;

(11) A full description of any professional, financial or other business transactions or arrangements which have been entered into within 1 year prior to the date of the filing of the application by each air carrier applicant with the individual applicant and by each air carrier applicant or individual applicant with any person with whom the individual applicant has or seeks to have an interlocking relationship, together with a full statement as to any such transactions or arrangements which it is contemplated may be entered into while such interlocking relationship continues.

(b) Each application shall state fully such further facts as the applicants respectively deem desirable in order to show that the public interest will not be adversely affected by the approval by the Board of the interlocking relationship.

§ 251.4 *Approval of system of affiliated and subsidiary companies.* (a) In the event that an individual occupies or seeks to occupy an interlocking relationship falling within the purview of section 409 (a) of the act which involves only the holding by him of the position of officer or director in two or more companies within the same system of affiliated and subsidiary companies (as hereinafter defined), an application for approval of such relationships need not comply with the requirements of § 251.3 (a) (11) but shall comply with all other requirements of that section. Such application shall also include:

(1) Such information as is necessary to disclose the fact that the companies in which the individual applicant occupies or seeks to occupy the interlocking relationships are members of the system of affiliated and subsidiary companies as defined herein, and

(2) A statement that the individual applicant does not occupy or seek to occupy any interlocking relationship falling within the purview of section 409 (a) of the act other than those within the same system of affiliated and subsidiary companies.

(b) The individual applicant may include in any application made by him pursuant to this part a request for an order authorizing him to hold generally, in addition to the positions so specifically requested, directorships or offices within the same system of affiliated and subsidiary companies, and it shall not be necessary to file a separate application with respect to each such relationship. Any applicant assuming a directorship or office pursuant to such authorization shall, not later than 15 days after assuming such directorship or office, make or cause to be made a full and complete report thereof to the Board. As used in this part, the term "system of affiliated and subsidiary companies" shall include only a specified company and those companies of which it, directly or indirecfitly, through one or more intermediate companies, owns 50 percent or more of the voting capital stock issued by such companies.

§ 251.5 *Supplements to applications.* Applicants under this part shall, upon requests of the Board and within such time as may be allowed, supplement any application with such information as may be required by the Board. In the event of any substantial change in the information set forth in the application prior to a decision by the Board upon such application, either by reason of the individual applicant's election or appointment to another position or positions involving an interlocking relationship or otherwise, the application shall be supplemented by such information as will fully describe such change. Such supplements shall comply with the formal requirements of § 251.2.

§ 251.6 *Uninterrupted tenure; no new applications required.* After the individual applicant has been authorized by the Board to hold a particular position, further application in connection with each successive term will not be required so long as he continues in uninterrupted tenure of such position, unless otherwise ordered by the Board.

§ 251.7 *Notice of changes in positions.* In the event of the individual applicant's resignation, withdrawal, or failure of reelection or reappointment with respect to any of the positions for which authorization has been granted by the Board, or in the event of any other material or substantial change therein, the individual and each air carrier applicant shall promptly and not more than 30 days after any such change occurs give notice thereof to the Board, setting forth fully the details of any such change. Such notices shall comply with the formal requirements of § 251.2, except that the verification may be in simple form.

§ 251.8 *Extent of authorization to hold position.* An order by the Board authorizing an individual applicant to hold the position of director of a Company will be construed as sufficient to authorize him to serve also as chairman of the board of directors or as a member or chairman of any committee or committees of such board.

§ 251.9 *Revocation of authorization to hold position.* Any order issued by the Board pursuant to section 409 (a) of the act shall be subject to revocation in whole or in part by the Board at any time if it deems that the public interest will be adversely affected by the holding by the individual applicant of any or all of the positions authorized to be held by such order. If any individual or air carrier applicant knowingly or wilfully withholds any information called for by this part or any other information which may be material or relevant to the application, or misrepresents facts disclosed in the application, such omission or misrepresentation may be considered sufficient cause for the immediate revocation of any such order.

§ 251.10 *Effect of order.* No order of the Board entered in connection with any application filed pursuant to this part shall constitute approval by the Board of any interlocking relationship which was not fully disclosed.

§ 251.11 *Reports.* An individual occupying an interlocking relationship pursuant to authorization of the Board may be required to file such periodic or special reports as the Board may deem necessary.

§ 251.12 *Prior applications.* Any application filed prior to March 10, 1942 shall not be subject to the provisions of this part, except to the extent that the Board may, by appropriate request, in particular cases require compliance with any specific provision or provisions hereof.

§ 251.13 *Procedure governing disposition of applications.* (a) Each application will be docketed as received and applicants will be advised of the docket number assigned thereto.

(b) If the Board is convinced by the application and its consideration and investigation thereof that applicants have made a due showing that the public interest will not be adversely affected by the interlocking relationships for which approval is sought, an order of approval will be entered.

(c) If the Board is not convinced that applicants have made a due showing applicants will be advised to that effect by letter. Thereupon applicants may file with the Board a petition in the proceeding for leave to withdraw the application, may request that the application be assigned for hearing, or may submit within a reasonable time to be fixed by the Board such additional information as they believe will result in a due showing.

(d) In the event additional information is submitted, the Board reserves the right to assign the application for hearing on its own initiative or to enter an order of approval or disapproval in accordance with its determination that a due showing has or has not been made.

(e) The Board further reserves the right to vary the procedure herein set forth insofar as necessary or desirable in disposing of any particular application.

Pooling and Other Agreements

PART 261—FILING OF AGREEMENTS

Sec.

AUTHORITY: §§ 261.1 to 261.7 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 412, 52 Stat. 1004, 49 U. S. C. 492.

SOURCE: §§ 261.1 to 261.7 appear at 14 F. R. 3545.

§ 261.1 *Who shall file.* (a) The filing of copies of contracts and agreements which are required to be filed under the provisions of section 412 (a) of the Civil Aeronautics Act of 1938, as amended, shall be made by every air carrier which is a party thereto. However, if the required number of copies are filed by any air carrier which is a party to such contract or agreement, any other air carrier which is a party shall be deemed to have complied with this requirement if it transmits to the Board, within the time prescribed by § 261.4, a signed statement to the effect that it concurs in such filing.

(b) The filing of copies of contracts or agreements evidenced by resolutions or other action of association of air carriers may be effected in the following manner. The Secretary or other authorized officer of the association may be designated as agent for the purpose of making such filing. Each air carrier which is a member of such association shall separately transmit to the Board a written statement, signed by such air carrier, reciting that a designated person or persons holding the office of secretary or other office of the association, or that any person or persons holding a designated office or offices of the association is constituted the attorney in fact for the filing of copies of any contracts or agreements evidenced by resolution or other action of the association to which such air carrier may become a party. Such authorizations may be revoked at any time by any air carrier by giving formal notice of revocation to the Board.

§ 261.2 *Number of copies.* (a) Unless express permission to file fewer copies is granted, there shall be filed with the Board three true and complete copies of all contracts and agreements which are required to be filed under the provisions of section 412 (a) of the Civil Aeronautics Act of 1938, as amended. Oral contracts and agreements required to be filed under the provisions of said section shall be evidenced by true and complete written memorandums and three true and complete copies of such memorandums shall be filed with the Board. The filing of contracts or agreements evidenced by correspondence or by resolutions of associations of air carriers shall be made by filing with the Board three true and complete copies of such correspondence or resolutions, as the case may be.

(b) Additional copies of contracts or agreements shall be furnished to the Board upon request.

§ 261.3 *Formal requirements of documents filed.* All documents filed hereunder shall be on strong, durable white paper and, if possible, not larger than $8\frac{1}{2}$ inches by 13 inches in size, except that tables, charts, maps, and other documents larger than that size may be folded to approximately the required measurements. The left margin should be at least $1\frac{1}{2}$ inches wide and if the document is bound, it should be bound on the left side. One copy of each typewritten document should be carbon-backed.

§ 261.4 *Place and time of filing.* The required number of copies of formal written contracts or agreements shall be filed at the office of the Board in Washington, D. C., addressed to the Operations Division, Civil Aeronautics Board, within 15 days after the date of execution thereof. The required number of copies of memoranda of oral contracts or agreements and of correspondence or resolutions evidencing contracts or agreements shall be filed in the same manner, within 30 days after such contracts or agreements have been entered into between the parties. The time of filing prescribed herein may be extended by the Board in exceptional circumstances upon proper application therefor.

§ 261.5 *Certification and verification.* (a) One copy of each formal written contract or agreement filed shall bear the certification of the secretary or other duly authorized officer of the filing party or parties to the effect that such copy is a true and complete copy of the original written instrument executed by the parties.

(b) One copy of each memorandum of oral contracts or agreements filed shall be verified by the secretary or other duly authorized officer of the filing party or parties to such oral contract or agreement. The person or persons verifying such memorandum shall set forth that they are fully familiar with all the terms and conditions of such oral contract or agreement and that the memorandum filed is a true and complete memorandum thereof.

(c) Copies of correspondence evidencing contracts or agreements shall be accompanied by the certifications of the secretary or other duly authorized officer of the filing party or parties to the effect that such copies are true and complete copies of the originals of such correspondence.

(d) One copy of each contract or agreement evidenced by resolution or other action of associations of air carriers shall bear the certification of the secretary of the association to the effect that such copy is a true and complete copy of the resolution duly adopted by the association on a certain date. The secretary shall also specify in such certification the name of each air carrier which concurred in such resolution or other action and the name of each air carrier member which did not so concur.

§ 261.6 *Modifications or cancellations.* This part shall be applicable to all modifications or cancellations of contracts or agreements required to be filed under the provisions of section 412 (a) of the Civil Aeronautics Act of 1938, as amended.

§ 261.7 *Contracts or agreements previously filed.* Contracts or agreements which have been filed prior to August 1, 1939, shall not be subject to the provisions of this part, except to the extent that the Board may by appropriate request in particular cases require compliance with any specific provision or provisions hereof.

PART 262—AGREEMENTS BETWEEN AIR CARRIERS AND FOREIGN COUNTRIES

AUTHORITY: §§ 262.1 to 262.4 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 1102, 52 Stat. 1026, 49 U. S. C. 672.

SOURCE: §§ 262.1 to 262.4 appear at 14 F. R. 3546.

§ 262.1 *Filing required.* Every air carrier shall file with the Board true and complete evidence, as specified in § 262.2 of each agreement in any way affecting or involving operating rights and in force on October 11, 1943 or thereafter issued or entered into as between such air carrier, or any officer or representative thereof, and any foreign country or political subdivision thereof, or any department, agency, officer or representative of such country or subdivision. For the purposes of this part, the term "agreement" means and includes any permit, concession, franchise, contract, understanding, or arrangement, and also any amendment, modification, renewal, rescission or revocation of any thereof.

§ 262.2 *Evidence of agreement.* (a) The evidence of such agreement shall be as follows:

(1) If written in English, three copies thereof;

(2) If written in a foreign language, three copies and three translations thereof;

(3) If oral, three copies of a descriptive memorandum thereof; or

(4) If evidenced by correspondence only, three copies of such correspondence and, if such correspondence, in whole or in part, is written in a foreign language, three translations of the part that is so written.

(b) In any case where translations are required, the copies to be filed shall be copies of official translations if official translations have been made.

§ 262.3 *Verification and formal specifications.* Evidence of agreements filed hereunder shall meet, insofar as possible, the requirements set forth in § 302.3 of this chapter as to verification and formal specifications of papers.

§ 262.4 *Time of filing.* Such evidence shall be filed within 60 days after such agreement has been issued or entered into, except that agreements which have been issued or entered into prior to October 11, 1943 shall be filed within 60 days after such date.

Classification and Exemption of Carriers

PART 290—APPLICATION FOR EXEMPTIONS OF CARRIERS

AUTHORITY: §§ 290.1 to 290.4 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 416, 52 Stat. 1004, 49 U. S. C. 496.

SOURCE: §§ 290.1 to 290.4 appear at 14 F. R. 3546.

§ 290.1 *Notice to interested parties required.* (a) Prior to or coincident with the filing of any application for exemption from the requirements of Title IV of the Civil Aeronautics Act of 1938, as amended, or any provision thereof, or any rule, regulation, term, condition, or limitation prescribed thereunder, the applicant, unless otherwise authorized by the Board, shall cause a notice of such filing to be served by personal service or registered mail upon all persons who may have an interest in the subject matter of the application; *Provided, however,* That any large irregular carrier, as defined in Part 291 of this chapter, filing such application for exemption prior to June 20, 1949, shall not be required to cause a notice of such filing to be served upon any of the persons having an interest therein if such application requests exemption authority to engage in irregular air transportation other than between specified points. In the case of any application which proposes the furnishing or discontinuance of air transportation to or from any point, the following persons shall be presumed to have an interest in the subject matter of the application:

(1) Any scheduled air carrier which regularly renders service to any point involved in the application;

(2) Any person whose application for a certificate of public convenience and necessity authorizing regular service to or from any such point has been filed with, and has not finally been disposed of, by the Board;

(3) The chief executive of any State, Territory, or possession of the United States in which any such point is located; and

(4) The chief executive of the city, town, or other unit of local government at any such point located in the United States or any Territory or possession thereof.

(b) Such notice shall indicate the date upon which the application will be or is being filed and, unless accompanied by a copy of the application, shall contain a brief statement of the relief requested.

§ 290.2 *Form and contents of application.* The application shall be entitled Application for Exemption Order and in addition to the specific relief requested, shall contain a list of the persons upon whom notice of the filing thereof was or is being served, and facts relied upon to establish that the enforcement of the matter from which exemption is sought is or would be an undue burden upon the applicant by reason of the limited extent of, or unusual circumstances affecting, the operations of such applicant, and is not in the public interest. An executed original and nine copies of such application with a copy of the notice attached to each shall be filed with the Board.

§ 290.3 *Additional service of notice.* Action on the application may be withheld by the Board, in its discretion, pending proof of such additional service of notice by the applicant as the Board may direct.

§ 290.4 *Emergency application.* In the event of an emergency requiring immediate action, an application may be filed by telegraph if it substantially conforms to the requirements hereof as to contents and notice (which notice in such case may be served by telegraph) and states the reasons deemed to necessitate immediate action.

PART 291—CLASSIFICATION AND EXEMPTION OF IRREGULAR AIR CARRIERS

Sec.
291.1 Definitions.
291.2 Classification.
291.3 Small irregular carriers; exemptions.
291.4 Small irregular carriers; duration of exemption.
291.5 Small irregular carriers; approval of certain interlocking relationships.
291.6 Small irregular carriers; effect on other statutes.
291.7 Small irregular carriers; conditions to exercise of temporary exemption privilege.
291.8 Small irregular carriers; issuance of letter of registration.
291.9 Small irregular carriers; restrictions on issuance of letter of registration.
291.10 Small irregular carriers; effective period of letter of registration.
291.11 Small irregular carriers; nontransferability of letter of registration.
291.12 Small irregular carriers; suspension of letter of registration.
291.13 Small irregular carriers; revocation of letter of registration.
291.14 Small irregular carriers; cancellation of letter of registration.
291.15 Large irregular carriers; exemptions.
291.16 Large irregular carriers; duration of exemption.
291.17 Large irregular carriers; condition to exercise of temporary exemption privilege.
291.18 Large irregular carriers; nontransferability of letter of registration.
291.19 Large irregular carriers; suspension of letter of registration.
291.20 Large irregular carriers; revocation of letter of registration.
291.21 Large irregular carriers; cancellation of letter of registration.
291.22 Large irregular carriers; interlocking relationships.
291.23 Large irregular carriers; operational limitations.
291.24 Nonapplicability.
291.25 Separability.
291.26 Past violations.

AUTHORITY: §§ 291.1 to 291.26 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 416, 52 Stat. 1004, 49 U. S. C. 496.

SOURCE: §§ 291.1 to 291.26 appears at 14 F. R. 3546.

NOTE: The following interpretation of Part 291 was adopted by Regulation Serial No. ER-136, 13 F. R. 7769.

Examples of irregular air transportation within the meaning of Part 291. For the guidance of irregular air carriers and other interested parties the Board here sets forth a number of illustrative examples of irregular and regular service. All irregular air carriers should study these examples, for the Board expects to use them as standards to apply to the operations of such carriers.

It should be noted that all of the illustrations included here refer only to actual operations. Such operations indicate a course of conduct constituting the holding out of regular or irregular service, as the case may be. The holding out of regular service may also be brought about by means other than actual operations—for example, although its services are operated irregularly, a carrier may be holding out regular service by reason of the nature and extent of its advertising and traffic solicitation efforts. In other words, an irregular air carrier is not immune from enforcement action if its actual operations are irregular but all the circumstances surrounding its business show that the carrier is holding out regular service.

The illustrations included represent application of the principles announced in *Page Airways, Inc., Investigation*, 6 CAB 1061, *Trans-Marine Airways, Inc., Investigation of Activities*, 6 CAB 1071, and *Investigation of Nonscheduled Services*, 6 CAB 1049, and more particularly of the cease and desist order entered in the *Matter of the Noncertificated Operations of Trans Caribbean Air Cargo Lines Inc.*, Order Serial No. E-370, adopted March 14, 1947. This is emphasized because the Board is not attempting by revision of Part 291 either to enlarge or contract the scope of operations permitted by the regulation.

(1) An irregular air carrier operates between points A and B, in one direction, on the days of the month which appear in brackets on the following calendar table:

S	*M*	*T*	*W*	*T*	*F*	*S*
[1]	2	3	4	5	6	7
[8]	9	10	11	12	13	14
[15]	16	17	18	19	20	21
[22]	23	24	25	26	27	28
[29]	30	31				

Since these flights are conducted on the same day of each week, the service is not irregular within the meaning of Part 291. Moreover, if over a period of weeks an occasional Sunday flight is omitted, or is operated on some other day of the week, such minor variations in the general pattern of regularity would not cause the service to become an irregular service.

(2) An irregular air carrier operates between points A and B, in one direction, on the days of the month which appear in brackets on the following calendar table:

S	*M*	*T*	*W*	*T*	*F*	*S*
—	1	[2]	3	[4]	5	6
7	8	[9]	10	[11]	12	13
14	15	[16]	17	[18]	19	20
21	22	[23]	24	[25]	26	27
28	29	[30]				

These flights are conducted regularly, twice a week, without frequent and extended definite breaks in service and are obviously not irregular within the meaning of Part 291. Moreover, if over a period of weeks an occasional flight is omitted, or is operated on some other day of the week, such minor variations in the general pattern of regularity would not cause the service to become an irregular service.

(3) An irregular air carrier operates between points A and B, in one direction, on the days of the month which appear in brackets on the following calendar table:

S	*M*	*T*	*W*	*T*	*F*	*S*
—	—	—	[1]	2	3	4
5	6	[7]	8	9	10	11
12	[13]	14	15	16	17	[18]
19	20	21	[22]	23	24	25
[26]	27	28	29	[30]		

These flights are conducted at regularly recurring periods, or substantially regular periods (every 4, 5 or 6 days), and therefore do not achieve infrequency and irregularity of service through frequent and extended definite breaks in service. Such service is not irregular within the meaning of Part 291.

(4) An irregular air carrier operates between points A and B in one direction, on the days of the two successive months which appear in brackets on the following calendar table:

S	*M*	*T*	*W*	*T*	*F*	*S*
—	—	—	—	—	[1]	2
3	4	[5]	6	[7]	8	9
10	[11]	[12]	13	14	15	16
17	18	[19]	[20]	21	22	23
24	[25]	26	[27]	28	29	30
31						
—	1	[2]	3	[4]	5	6
7	8	9	[10]	11	12	[13]
14	15	16	17	18	19	20
21	[22]	23	24	[25]	26	27
[28]	29	30	[31]			

These flights are conducted twice a week in succeeding weeks without the intervention of other weeks or similar periods at irregular but frequent intervals during which no flights are operated. Such service is not irregular within the meaning of Part 291.

(5) An irregular air carrier operates between points A and B, in one direction, on the days of the two successive months which appear in brackets on the following calendar table:

S	*M*	*T*	*W*	*T*	*F*	*S*
—	—	—	—	—	[1]	2
[3]	[4]	5	[6]	7	[8]	9
10	11	[12]	[13]	14	15	16
17	[18]	19	[20]	21	[22]	23
24	25	26	27	28	29	30
[31]						
—	[1]	2	[3]	4	5	[6]
7	8	[9]	[10]	11	12	13
[14]	15	[16]	17	[18]	[19]	20
21	22	23	24	25	26	27
[28]	[29]	30				

In this pattern, unlike the preceding example, two breaks of at least a week occur within a 2-month period. However, operations in the other weeks occur with such frequency that the breaks in service are not of sufficient frequency and extent to compensate for the substantial number of flights conducted with frequency over a substantial period. The flights are not irregular within the meaning of Part 291.

(6) An irregular air carrier operates between points A and B, in one direction, on the days of the two successive months which appear in brackets on the following calendar table:

S	*M*	*T*	*W*	*T*	*F*	*S*
—	—	—	1	2	[3]	4
5	6	[7]	8	9	[10]	11
12	13	14	15	16	17	18
19	20	[21]	22	23	[24]	25
26	27	[28]	[29]	30	31	
—	—	—	—	—	—	1
2	3	[4]	5	6	[7]	8
9	10	11	12	13	14	[15]
16	17	[18]	19	20	[21]	22
23	24	[25]	26	27	[28]	29
30	31					

The flights do not exceed two per week and the 2-month period includes two definite breaks in service. However, in view of the frequent rendition of service on Tuesdays and Fridays the breaks in service and comparatively small number of flights operated are not sufficient to destroy the pattern of regularity. The service is not irregular within the meaning of Part 291.

(7) An irregular air carrier operates between points A and B, in one direction, on the days of the two successive months which appear in brackets on the following calendar table:

S	*M*	*T*	*W*	*T*	*F*	*S*
—	1	[2]	3	[4]	5	[6]
7	[8]	9	[10]	11	[12]	13
14	15	16	17	18	19	[20]
21	[22]	23	[24]	25	[26]	27
[28]	29	[30]	31			
—	—	—	—	[1]	2	[3]
4	5	6	7	8	9	10
[11]	12	[13]	14	[15]	16	[17]
18	[19]	20	[21]	22	[23]	24
25	26	27	28	29	30	[31]

These flights are operated every other day except for infrequent breaks. Such service is not irregular within the meaning of Part 291.

(8) Four large irregular air carriers agree to utilize the services of a single ticket agency, XYZ Ticket Agency, Inc., with respect to service between points A and B, and to furnish to the agent the dates upon which each will operate between A and B. If the flights, considered in combination, of such carriers between A and B reveal a pattern of operations similar to those shown in examples (1) through (7) above, the combination of flights constitute regular air transportation and each such carrier is deemed to be conducting regular operations between A and B.

(9) An irregular air carrier operates between points A and B, in one direction, on the days of the month which appear in brackets on the following calendar table:

S	*M*	*T*	*W*	*T*	*F*	*S*
—	—	[1]	2	3	4	5
6	7	8	[9]	10	11	12
13	14	15	16	[17]	18	19
20	21	22	23	24	25	[26]
27	[28]	29	30	31		

These flights are conducted on a different day of each week, and are operated only after frequent and definite breaks in service. Although two flights (on the 26th and 28th) were operated within one period of less than one week, this frequency was compensated for by the breaks of at least a week between the other flights. The flights are therefore irregular within the meaning of Part 291.

(10) An irregular air carrier operates between points A and B, in one direction, on the days of the two successive months which appear in brackets on the following calendar table (numerals above and to the left of dates appearing in brackets indicate the number of flights operated on those dates):

S	*M*	*T*	*W*	*T*	*F*	*S*
—	1	2	3	4	5	6
7	8	[9]	[10]	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
[28]	29	30				
—	—	—	1	2	3	4
[5]	[^{2}6]	[^{3}7]	[^{2}8]	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	[29]	[^{2}30]	31	

These flights are conducted in such manner that frequent, extended and definite breaks in service occur at irregular intervals and therefore the service is irregular within the meaning of Part 291.

§ 291.1 *Definitions*—(a) *Irregular air carrier.* The term irregular air carrier means any air carrier which (1) directly engages in air transportation, (2) does not hold a certificate of public convenience and necessity under section 401 of the Civil Aeronautics Act of 1938, as amended, and (3) does not operate, or hold out to the public expressly or by course of conduct that it operates, one or more aircraft between designated points, or within a designated point, regularly or with a reasonable degree of regularity, upon which aircraft it accepts for transportation, for compensation or hire, such members of the public as apply therefor or such property as the public offers. No air carrier shall be deemed to be an irregular air carrier unless the air transportation services offered and performed by it are of such infrequency as to preclude an implication of a uniform pattern or normal consistency of operation between, or within, such designated points.

(b) *Point.* The term "point" as used in this part shall mean any airport or place where aircraft may be landed or taken off, including the area within a 25-mile radius of such airport or place.

§ 291.2 *Classification.* (a) There is hereby established a classification of noncertificated air carriers to be designated as "irregular air carriers."

(b) Any irregular air carrier, as classified above, which does not use in its transportation services aircraft units having a gross take-off weight in excess of 10,000 pounds for any one unit or of 25,000 pounds for the total of such units (disregarding units of 6,000 pounds or less), shall be classified as a small irregular carrier.

(c) Any irregular air carrier other than a small irregular carrier shall be classified as a large irregular carrier: *Provided,* That no air carrier shall be so classified unless it holds a letter of registration issued to it as a large irregular carrier pursuant to application therefor filed with the Board before August 6, 1948, and not revoked or cancelled as of May 20, 1949.

§ 291.3 *Small irregular carriers; exemptions.* Except as otherwise provided in this section, each small irregular carrier, falling within the classification above, shall be temporarily exempt from the following provisions of Title IV of the Civil Aeronautics Act of 1938, as amended:

(a) Subsection 401 (a);
(b) Section 403;
(c) Subsection 404 (a); *Provided,* That small irregular carriers shall abide by those provisions of this subsection which require air carriers to provide safe service, equipment and facilities in connection with air transportation;
(d) Subsection 404 (b);
(e) Subsection 405 (e);
(f) Subsection 407 (b);
(g) Section 408;
(h) Subsection 409 (a); and
(i) Section 412.

§ 291.4 *Small irregular carriers; duration of exemption.* The temporary exemption from any provision of Title IV of the act provided by § 291.3 shall continue in effect only until such time as the Board shall find that enforcement thereof would be in the public interest or would no longer be an undue burden on the small irregular carriers; *Provided,* That upon such a finding as to any small irregular carrier or class of small irregular carriers, such exemption shall to that extent terminate with respect to such carrier or class of carriers.

§ 291.5 *Small irregular carriers; approval of certain interlocking relationships.* To the extent that any officer or director of a small irregular carrier would, without prior approval of the Board, be in violation of any provisions of subsection 409 (a) of the Civil Aeronautics Act of 1938, as amended, by reason of any interlocking relationship directly involving such small irregular carrier, such relationship is hereby approved.

§ 291.6 *Small irregular carriers; effect on other statutes.* The temporary exemption granted in § 291.3 from sections 408, 409 (a) and 412 shall not constitute an order made under such sections, within the meaning of section 414, and shall not confer any immunity or relief from operation of the "antitrust laws", or any other statute (except the Civil Aeronautics Act of 1938, as amended), with respect to any transaction, interlocking relationship, or agreement otherwise within the purview of such section.

§ 291.7 *Small irregular carriers; conditions to exercise of temporary exemption privilege.* (a) No person shall exercise the temporary exemption privilege conferred by § 291.3 unless there is in effect with respect to such person a letter of registration issued by the Board, acknowledging that such person has been duly registered with the Board as a small irregular carrier under the provisions of this part, as amended, relating to irregular air transportation. Any small irregular carrier which holds a letter of registration issued to it, and not revoked or canceled, prior to May 20, 1949, is not required to obtain another letter of registration.

(b) No small irregular carrier shall make or maintain any agreement or arrangement with any other air carrier or air carriers with respect to the conduct of air transportation services which, if conducted by a single carrier, would take it out of the classification of an irregular air carrier as set forth in this part.

§ 291.8 *Small irregular carriers; issuance of letter of registration.* Except as provided in § 291.9, upon the filing of proper application therefor the Board will issue to any small irregular carrier a letter of registration. Such application shall be certified as correct by a responsible official of such carrier, and shall contain the following information: (a) Date; (b) name of carrier; (c) mailing address; (d) location of principal operating base; (e) if a corporation, the place of incorporation, the name and citizenship of officers and directors and a statement that at least 75 per centum of the voting interest is owned or controlled by persons who are citizens of the United States or of one of its possessions; (f) if an individual or partnership, the name and citizenship of owners or partners;

(g) the types and numbers of each type of aircraft utilized in air transportation. Such application shall be submitted in duplicate in letter form or on CAB Form No. 2789, which is available on request for the convenience of applicants.

§ 291.9 *Small irregular carriers; restrictions on issuance of letter of registration.* An application filed pursuant to § 291.8 will be denied and no letter of registration as a small irregular carrier will be issued to an applicant which has, or proposes to have, as owner, partner, officer, director, or stockholder holding a controlling interest, any person who was or is connected in any such capacity with any irregular air carrier, noncertificated cargo carrier, or air freight forwarder, if the letter of registration or exemption privilege of such carrier or forwarder was suspended or revoked by the Board on account of acts or omissions which occurred during the time of such connection, unless it has been shown to the Board by such applicant, and the Board finds, that the public interest and applicant's intention and ability to conform to the provisions of the act and requirements thereunder will not be adversely affected by such relationship or former relationship. For the purpose of carrying out the intent of this provision, the Board may, before or after the issuance of a letter of registration, require the applicant to furnish information in addition to that required to be set forth in its application filed pursuant to § 291.8.

§ 291.10 *Small irregular carriers; effective period of letter of registration.* Each letter of registration of a small irregular carrier shall become effective only upon the date specified therein and shall continue in effect until suspended, revoked or canceled, or until the temporary exemption privilege conferred by § 291.3 shall terminate or otherwise cease to be effective with respect to such small irregular carrier, whichever occurs first.

§ 291.11 *Small irregular carriers; nontransferability of letter of registration.* A letter of registration shall be nontransferable and shall be effective only with respect to the person or persons named therein.

§ 291.12 *Small irregular carriers; suspension of letter of registration.* Letters of registration shall be subject to immediate suspension when, in the opinion of the Board, such action is required in the public interest. Letters of registration shall be further subject to suspension, without hearing or other proceedings, for continuing failure to file tariffs or reports as required by provisions of the act or any order, rule or regulation issued thereunder, after not less than 10 days' notice to the small irregular carrier within which to comply with such requirement. Such suspension shall continue until the Board finds that such suspended carrier has complied with or submitted satisfactory evidence and assurance that it will comply with the provisions of the act or such rules, regulations or orders. Failure to seek reinstatement of a letter of registration suspended pursuant to the provisions of this subparagraph within a period of 60 days after notice to the carrier of such suspension shall automatically terminate all rights under such letter of registration; *Provided*, That in the case of a letter of registration suspended prior to May 20, 1949, failure to seek reinstatement of such letter of registration, prior to July 20, 1949, shall automatically terminate all rights under such letter of registration.

§ 291.13 *Small irregular carriers; revocation of letter of registration.* Letters of registration shall be subject to revocation, after notice and hearing, for knowing and willful violation of any provisions of the act or of any order, rule, or regulation issued under any such provision or of any term, condition, or limitation of any authority issued under said act or regulations, or for any cause which, at the time of revocation, would justify the Board in refusing to issue to the holder of such letter a like letter.

§ 291.14 *Small irregular carriers; cancellation of letter of registration.* (a) The letter of registration of any small irregular carrier shall be canceled without prejudice upon the filing by such carrier of a written request for cancellation; *Provided*, That the Board may refuse to grant such request if any proceeding or action is pending in which the small irregular carrier's letter of registration may be subject to suspension or revocation.

(b) In any case in which the Board has reason to believe that a small irregular carrier has ceased to operate pursuant to the temporary exemption privilege conferred by § 291.3, the Board may, by registered letters mailed to the carrier at its last known address and to the designated agent of such carrier, if any, request such carrier to advise the Board, within 60 days after receipt thereof, whether such carrier wishes to continue such operations or to have its letter of registration canceled. Failure to reply within a period of 60 days after receipt thereof, or return of such letters unclaimed, shall automatically terminate all rights under such letter of registration.

§ 291.15 *Large irregular carriers; exemptions.* Except as otherwise provided in this part, each large irregular carrier, falling within the classification above, shall be temporarily exempt from the following provisions of Title IV of the Civil Aeronautics Act of 1938, as amended:

(a) Subsection 401 (a);

(b) Subsection 404 (a): *Provided, however,* That each such large irregular carrier shall abide by these provisions of this subsection which require air carriers to provide safe service, equipment, and facilities in connection with interstate and overseas air transportation; and to establish, observe and enforce just and reasonable individual rates, fares and charges and just and reasonable classifications, rules, regulations and practices relating to such air transportation.

(c) Subsection 405 (e).

§ 291.16 *Large irregular carriers; duration of exemption.* The temporary exemption conferred by § 291.15 shall terminate and cease to be effective with respect to each large irregular carrier at 5 p. m., eastern daylight saving time, on June 20, 1949: *Provided*, That any large irregular carrier which before such time has on file with the Board pursuant to section 416 (b) of the act an application for an individual exemption from Title IV of the act extending to all or part of the air transportation which such large irregular carrier is authorized to perform as of June 19, 1949, pursuant to the temporary exemption conferred by § 291.15 may continue, except during any such time as its letter of registration may be suspended, to exercise such privilege until, but only until, the date specified in the Board's order finally disposing of its application for individual exemption, or until its letter of registration is revoked or canceled, whichever shall be earlier. Suspension of the letter of registration of a large irregular carrier shall not render such carrier ineligible to file an application for individual exemption hereunder.

§ 291.17 *Large irregular carriers; condition to exercise of temporary exemption privilege.* No person shall exercise the temporary exemption privilege conferred by § 291.15 unless there is in effect with respect to such person a letter of registration issued by the Board, acknowledging that such person has been duly registered with the Board as a large irregular carrier under the provisions of this part, as amended, relating to irregular air transportation.

§ 291.18 *Large irregular carriers; nontransferability of letter of registration.* A letter of registration of a large irregular carrier shall be nontransferable and shall be effective only with respect to the person or persons named therein.

§ 291.19 *Large irregular carriers; suspension of letter of registration.* Letters of registration of large irregular carriers shall be subject to immediate suspension when, in the opinion of the Board, such action is required in the public interest.

§ 291.20 *Large irregular carriers; revocation of letter of registration.* Letters of registration of large irregular carriers shall be subject to revocation, after notice and hearing, for knowing and willful violation of any provisions of the act or of any order, rule, or regulation issued under any such provisions or of any term, condition or limitation of any authority issued under said act or regulations.

§ 291.21 *Large irregular carriers; cancellation of letter of registration.* (a) The letter of registration of any large irregular carrier shall be cancelled without prejudice upon the filing by such carrier of a written request for cancellation: *Provided*, That the Board may refuse to grant such request if any proceeding or action is pending in which the carrier's letter may be subject to suspension or revocation.

(b) In any case in which the Board has reason to believe that a large irregular carrier has ceased to operate pursuant to the temporary exemption conferred by § 291.15, the Board may, by registered letters mailed to the carrier at its last known address and to the designated agent of such carrier, if any, request such carrier to advise the Board, within 60 days after receipt thereof, whether such carrier wishes to continue such operations or to have its letter of registration canceled. Failure to reply within a period of 60 days after receipt thereof, or return of such letters unclaimed, shall automatically terminate all rights under such letter of registration.

§ 291.22 *Large irregular carriers; interlocking relationships.* If an application by any large irregular carrier for approval of an interlocking relationship in existence on May 20, 1949, and heretofore exempt from the provisions of section 409 (a) is filed with the Board on or before June 20, 1949, such carrier may retain the officer, director, member or stockholder involved in such relationship pending final disposition by the Board of said application, and such relationship is hereby approved pending such final disposition.

§ 291.23 *Large irregular carriers; operational limitations.* Large irregular carriers shall not engage in the foreign air transportation of persons, and are not granted any exemption by this part from the provisions of the Civil Aeronautics Act of 1938, as amended, with respect to such foreign air transportation of persons.

§ 291.24 *Nonapplicability.* This part shall not apply to any air carrier authorized by a certificate of public convenience and necessity to engage in air transportation, to Alaskan air carriers, to operations within Alaska, or to any noncertificated air carrier engaged in air transportation pursuant to special or individual exemption by the Board or pursuant to exemption created by any other part of this subchapter.

§ 291.25 *Separability.* If any provisions of this part or the application thereof to any air transportation, person, class of persons, or circumstances is held invalid, the remainder of the part and the application of such provisions to other air transportation, persons, classes of persons, or circumstance shall not be affected thereby.

§ 291.26 *Past violations.* All those provisions of this part in effect prior to the revision adopted April 13, 1949, which are included in the amendment without substantial change are hereby affirmed and continued in effect and all such provisions are intended to speak from the time of their first enactment. All references to violations of the Board's regulations include any violations at any time of the provisions of this part as then in effect, and the aforesaid revision shall in no way affect any pending enforcement proceeding or action, or any enforcement action taken subsequent of May 20, 1949, of this amendment with respect to violations which occurred prior to such date.

PART 292—CLASSIFICATION AND EXEMPTION OF ALASKAN AIR CARRIERS

Sec.

AUTHORITY: §§ 292.1 to 292.8 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply secs. 401 and 416, 52 Stat. 987, 1004; 49 U. S. C. 481, 496.

SOURCE: §§ 292.1 to 292.8 appear at 14 F. R. 3550.

§ 292.1 *Classification.* (a) There is hereby established, within the meaning of section 416 (a) of the Civil Aeronautics Act of 1938, a classification of air carriers which, except as otherwise authorized in § 292.2 (b) and § 292.3 (a) (2), engage solely in air transportation within the Territory of Alaska, said classification to be designated as Alaskan air carriers. Such classification shall include both (1) certificated air carriers and (2) air carriers operating under the authority of § 292.3.

(b) There is hereby established a further classification of air carriers operating in Alaska to be designated Alaskan pilot-owners. As used in this section an Alaskan pilot-owner carrier shall mean a certificated pilot with a commercial or airline transport rating who:

(1) Directly or indirectly engages as a principal in air transportation solely within the Territory of Alaska;

(2) Utilizes in such air transportation only aircraft which have a certificated capacity of no more than four passengers, and which are beneficially owned and flown exclusively in air transportation by him alone;

(3) Is not otherwise authorized by the Board to engage in air transportation.

§ 292.2 *Temporary exemption of certificated air carriers.* Until the Board shall adopt further rules, regulations, or orders, an Alaskan air carrier which holds a certificate of public convenience and necessity issued by the Board shall be exempt, subject to the conditions and requirements set forth in this part, from sections 401 (a) and 404 (a) of the act insofar as the enforcement of said sections would prevent any such air carrier:

(a) From providing, over a regular route designated in a certificate of public convenience and necessity, service, of the same type authorized by the certificate, to such additional points not named in the certificate as are situated within the Territory which would ordinarily be served by such route;

(b) From making charter trips and rendering other special services between points on routes which it is authorized by its certificate to serve. (Charter trips and other special services may also be rendered to or from any other point within or outside the Territory of Alaska: *Provided, however,* That such trips originate at or are destined to a point on a route, regular or irregular, the carrier is authorized by its certificate to serve: *And, provided further,* That all such trips are casual, occasional, or infrequent, and are not made in such manner as to result in establishing a regular or scheduled service);

(c) From transporting over postal routes 78182 and 78187 (blanket authorization of the Postmaster General relating to the transportation of first-class mail) and over postal routes designated by the Postmaster General as "gratuitous" routes, such mail as may be tendered by postmasters in Alaska for transportation over such routes.

§ 292.3 *Temporary exemption of noncertificated air carriers.* (a) Until the Board shall adopt further rules, regulations, or orders, any air carrier engaging in air transportation within the Territory of Alaska which (i) does not hold a certificate of public convenience and necessity, (ii) during the 6 months ending March 31, 1945, was engaging within the Territory of Alaska in air transportation which had not been authorized by the Board, and (iii) has heretofore filed on or prior to September 15, 1945, an application for a permanent or temporary certificate of public convenience and necessity covering such services, shall be exempt, subject to the conditions and requirements hereinafter set forth, from sections 401 (a) and 404 (a) of the act insofar as the enforcement of said sections would otherwise prevent:

(1) Any such air carrier from continuing to engage in air transportation of the same nature, extent, regularity and frequency as was rendered by it within the Territory of Alaska during said period ending March 31, 1945, and for which air transportation such air carrier filed, on or prior to September 15, 1945, an application for a permanent or temporary certificate of public convenience and necessity;

(2) Any such air carrier from making charter trips and rendering other special services between points on routes over which it is authorized to serve by the terms of subparagraph (1) of this paragraph with equipment utilized thereunder. (Charter trips and other special services may also be rendered with such equipment to or from any other point, within or outside the Territory of Alaska: *Provided,* That such trips originate at or are destined to a point on a route such air carrier is authorized to serve by the terms of subparagraph (1) of this paragraph: *And provided, further,* That all such trips are casual, occasional, or infrequent, and are not made in such a manner as to result in establishing a regular or scheduled service.)

(b) The exemptions granted in paragraph (a) of this section shall be of no further force and effect as to any air carrier from and after the effective date of an order of the Board denying the aforesaid application of such carrier filed prior to September 15, 1945, or from the date of the inauguration of air transportation pursuant to an authorization of the Board granting such application in whole or in part;

(c) Until the Board shall adopt further rules, regulations, or orders, any air carrier engaging in air transportation within the Territory of Alaska pursuant to a specific exemption order adopted by the Board pursuant to section

416 (b) of the act shall be exempt, subject to the conditions and requirements hereinafter set forth, from sections 401 (a) and 404 (a) of the act insofar as the enforcement of said sections would otherwise prevent any such air carrier from continuing to engage in air transportation of the same nature, extent, regularity, and frequency as is authorized by the Board in the specific exemption order applicable to such carrier. The exemption granted in this paragraph shall remain in force and effect as to any air carrier for the term provided for in, and in accordance with the terms of, the order granting the specific exemption for such air carrier.

(d) Until September 30, 1949, or until such earlier date that the Board may make effective further rules, regulations, or orders relative hereto, any Alaskan pilot-owner carrier shall be exempt, subject to the conditions and requirements herein set forth, from sections 401 (a) and 404 (a) of the act, insofar as the enforcement thereof would prevent any such person from engaging in the air transportation of persons or property within the Territory of Alaska on a casual, occasional, or infrequent basis, and in such manner as will not result in the establishment of a regular or scheduled service.

§ 292.4 *Regulation.* (a) This subchapter shall not be applicable to Alaskan air carriers except to the extent provided in this section. Subject to the provisions of paragraphs (b) and (c) of this section, the following regulations are made applicable to Alaskan air carriers:

Part 200 (Definitions and Instructions).

Part 201 (Applications for Certificates of Public Convenience and Necessity).

Part 205 except § 205.6 (Temporary Suspension of Service Authorized by Certificates of Public Convenience and Necessity).

Part 206 (Certificates of Public Convenience and Necessity; Temporary Change of Route).

Parts 221 and 222 (Preparation of Tariffs of Air Carriers and Filing and Posting of Tariffs of Air Carriers).

Part 223 (Tariffs of Air Carriers; Free and Reduced-Rate Transportation).

Part 224 (Tariffs of Air Carriers; Free and Reduced-Rate Transportation; Access to Aircraft for Safety Purposes).

Part 231 (Transportation of Mail; Mail Schedules).

Part 232 (Transportation of Mail; Review of Orders of Postmaster General).

Part 233 (Transportation of Mail; Free Travel for Postal Employees).

Part 234 (Transportation of Mail; Petitions for Determination of Rates).

Part 241 (Reports by Certificated Air Carriers).

Part 245 (Reports of Ownership of Stock and Other Interests).

Part 246 (Reports of Stock Ownership of Affiliates of Air Carriers).

Part 248 (Submission of Audit Reports by Public Accountants).

Part 249 (Preservation of Accounts, Records, and Memorandums).

Part 251 (Prohibited Interests; Interlocking Relationships).

Part 261 (Filing of Agreements).

Part 262 (Agreements between Air Carriers and Foreign Countries).

Part 293 (Classification and Exemption of Carriers; Omission of Stop at Junction Point).

Rules of Practice.

(b) The Director of the Alaska Office may take preliminary action for the Board to relieve any Alaskan air carrier or group of Alaskan air carriers from complying with a specific provision or provisions of Parts 221, 222, 231, and 241 of this chapter when the application of any provision or provisions of these parts is found by him to be an undue burden on such Alaskan air carrier or air carriers by reason of the limited extent of, or unusual circumstances affecting, the operations of such Alaskan air carrier or air carriers. Upon finding that such relief is no longer necessary, the Director of the Alaska Office may take preliminary action for the Board to cancel the relief previously granted in accordance with the provisions of this section. The action of the Director shall be subject to ratification by the Board and any person affected by his action may file exceptions thereto with the Board within 15 days after the date the Director makes his action effective. The action of the Director under this section may be taken either on written application or may be initiated by him in the first instance. Whenever reference is made in Parts 221 or 222 of this chapter to the Bureau of Economic Regulation or to the Director of the Bureau of Economic Regulation, such reference shall be deemed to mean the Director of the Alaska Office.

(c) An Alaskan air carrier which prior to December 1, 1947, has suspended service to a point on a regular route named in its certificate, and which shall file, within 45 days after December 1, 1947, an "Application for Order Authorizing Temporary Suspension of Service" pursuant to Part 206 of this chapter is authorized to continue to suspend service to that point until its application shall have been granted or denied by the Board.

§ 292.5 *Procedural requirements.*—(a) *Place and time of filing:* Notwithstanding the requirements of any other regulation, order, or rule of the Board, all documents authorized or required by the Civil Aeronautics Act, or any regulation, order, or rule of the Board issued thereunder, to be filed with the Board by any Alaskan air carrier or in connection with air transportation performed or sought to be performed by such air carrier shall be filed in accordance with the methods and within the time limitations provided therein with the Director of the Alaska Office of the Board; *Provided,* That applications, motions, and petitions in formal proceedings filed through counsel having addresses outside of Alaska may be filed with the Board at its office in Washington, D. C., in which event one signed copy (being one of the duplicate originals specified in paragraph (b) of this section) of each such document shall be sent by air mail to the Director of the Alaska Office in Anchorage, Alaska, by the counsel so filing.

(b) *Duplicate originals required.* In addition to the number of copies of each document required to be filed by the regulation, order, or rule under which it is filed, one additional signed copy shall be filed, and if the regulation, order, or rule under which it is filed requires verification of documents filed thereunder, said additional signed copy shall also be verified. Two signed copies will constitute duplicate originals. In the event both copies are filed with the Director of the Alaska Office, that office shall transmit one signed copy to the office of the Board in Washington, D. C., and retain the other signed copy in the files of the Alaska Office.

(c) *Conformity to rules.* All such documents shall in all other respects conform to the requirements of the regulation, order or rule of the Board under which they are filed; *Provided,* That any such requirement may be waived or substantial compliance authorized by the Director of the Alaska Office if he finds that such requirement will constitute an undue burden on an air carrier or group of air carriers and strict compliance is unnecessary in view of the limited extent of or unusual circumstances affecting the operations of any such air carrier or group of air carriers.

(d) *Posting and preservation of documents.* The Alaska Office copy of all documents subject to this part which are required by the Act, or by the regulations, orders, or rules, of the Board, thereunder, to be posted in the Office of the Secretary of the Board shall be posted in the Office of the Director of the Alaska Office; and the Alaska Office copy of documents which are required by section 1103 of the act to be preserved as public records in the custody of the Secretary of the Board, shall be preserved as public records in the custody of the Director of the Alaska Office under such reasonable arrangements as he may make for public inspection thereof. Such posting and preservation as public records shall be in addition to that required of the Secretary of the Board.

(e) *Requests for additional information.* The Director of the Alaska Office may at any time require any person filing documents with the Alaska Office to file additional copies thereof, and to make service upon persons other than those specified in the pertinent regulation, order, or rule of the Board, if he finds such requirements necessary in the public interest or in the interest of efficiency and expedition in the work of the Board. If he is of the opinion that a formal or informal application, complaint, petition or other document does not sufficiently set forth the material required to be set forth by any applicable regulation, order or rule of the Board, or is otherwise insufficient, he may advise the party filing the same of the deficiency and require that any additional information be supplied. In case he deems an answer to formal complaints and petitions desirable, he may so notify the parties.

(f) *Extension of time.* The Director of the Alaska Office shall have authority, upon good cause shown, to extend the time for filing of any document required by this part to be filed with the Alaska Office.

(g) *Recommendations concerning regulations.* The Director of the Alaska Office may submit a draft of proposed regulations affecting air transportation within Alaska, or of amendments or modifications of such regulations to the Alaskan air carriers for comment. Upon expiration of the date fixed for submission of comments he shall transmit any comments received, together with his recommendations, to the Board for consideration. The Board may revise any such proposed regulation, amendment, or modification, and in respect of any substantial revision, may direct the Director of the Alaska Office to submit such revision to the Alaskan air carriers for further comment.

§ 292.6 *Formal proceedings*—(a) *Docket of Alaska Office.* A complete docket of all formal proceedings by or against Alaskan air carriers, or by or against persons seeking authority to engage in air transportation solely within the Territory of Alaska, shall be maintained in the offices of the Board at Washington, D. C., and in the Board's Alaska Office.

(b) *Exceptions and oral argument.* Exceptions to the initial or recommended decision of the examiner in any formal proceeding and briefs in support of such exceptions, may be filed with the Board at its office in Washington, D. C. One copy of such exceptions and briefs shall be sent by air mail to the Director of the Alaska Office by the party so filing; or may be filed with the Director of the Alaska Office, in which event they will be transmitted by him to the Board's office in Washington, D. C. If any of the parties to any such proceeding so desire, the Director of the Alaska Office may on behalf of the Board hear oral argument upon exceptions to the examiner's report, and shall transmit a transcript of such oral argument to the Board. Such oral argument before the Director of the Alaska Office shall be in lieu of oral argument before the Board.

(c) *Hearings and conferences.* Hearings and conferences in proceedings on the Board's Alaskan docket shall be assigned, and procedural notices (other than notice of oral argument before the Board) and examiner's report will be served by the Director of the Alaska Office.

§ 292.7 *Powers of the Director in formal proceedings.* Subject to the modification or reversal by the Board, on his own motion or upon petition or application of any air carrier or other person affected by or having a substantial interest in his action, the Director of the Alaska Office is authorized and designated to act for the Board in the following matters:

(a) *Intervention.* All petitions for intervention in proceedings on the Board's Alaska docket shall be referred to the Director of the Alaska Office who shall have authority to grant or deny such intervention. Any person whose petition for intervention shall have been denied by the Director of the Alaska Office may file exceptions thereto within 15 days after such denial and the Director of the Alaska Office shall submit such petition and exceptions to the Board for review.

(b) *Dismissal of applications.* The Director of the Alaska Office shall have authority to order dismissal of any application made to the Board pursuant to the Civil Aeronautics Act of 1938, as amended, and pending on the Board's Alaska Docket, when such dismissal is requested by the applicant or where the applicant has failed to prosecute such application.

(c) *Consolidation of applications.* The Director of the Alaska Office shall have authority to consolidate applications under Title IV of the act on the Board's Alaska Docket for hearing or issuance of initial or recommended decision by an examiner.

§ 292.8 *Alaskan pilot-owner; conditions and requirements.* Persons seeking to engage in air transportation as an Alaskan pilot-owner carrier shall be subject to the following conditions and requirements.

(a) Such persons shall first file with the Board a proper application for, and shall hold a currently effective letter of registration (Alaska), before undertaking to engage in such air transportation, except that any person engaged in service on May 28, 1948, and filing such application on or before such date may continue to engage in services of the nature and extent herein authorized until such letter of registration (Alaska) has been issued or he has been notified that no such letter will be issued;

(1) An application by an Alaskan pilot-owner for a letter of registration may be submitted to the Board in duplicate in letter form. Such application shall be certified to be correct by the applicant, and shall set forth the following information:

(i) Date.

(ii) Name, citizenship, address principal operating base, airman certificate number and ratings held by applicant, and whether applicant operates as individual enterprise, partnership, or corporation.

(iii) Number of aircraft units beneficially owned by applicant and utilized by him in air transportation, registration number, make, model of each aircraft, and type of landing gear employed, and the name in which each aircraft is registered.

(iv) Types of services and area in which services will be performed, and any seasonal variations in proposed services.

(2) Letters of registration (Alaska) shall be subject to immediate suspension when, in the opinion of the Board, such action is required in the public interest.

(3) Letters of registration (Alaska) shall be subject to revocation, after notice and hearing, for knowing and willful violation of any provision of the Civil Aeronautics Act of 1938, as amended, or of any order, rule, or regulation issued under any such provision, or of any term, condition, or limitation of any authority issued under said act or regulations.

(b) An Alaskan pilot-owner shall not engage in any air transportation between points on any route on which one or more carriers holding certificates of public convenience and necessity undertake, pursuant to schedules filed with the Board under section 405 (e) of the act, to provide service on an aggregate of three or more scheduled flights weekly;

(c) An Alaskan pilot-owner shall be subject to the provisions of §§ 292.4, 292.5, 292.6, and 292.7 in the same manner and to the same extent as an Alaskan air carrier.

Part 293—Classification and Exemption of Carriers; Omission of Stop at Route Junction Points

§ 293.1 *Omission of stop.* Notwithstanding the provisions of section 401 (a) of the act, an air carrier on any flight which is regularly scheduled to be operated between points on two or more of its certificated routes, via a junction point of such routes, may omit a stop at such junction point whenever weather conditions at such junction point otherwise would require the cancellation or postponement of any portion of such flight. (Sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interprets or applies sec. 416, 52 Stat. 1004, 49 U. S. C. 496) [14 F. R. 3552]

Part 295—Classification and Exemption of Noncertificated Cargo Carriers

Authority: §§ 295.1 to 295.12 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 416, 52 Stat. 1004, 49 U. S. C. 496.

Source: §§ 295.1 to 295.12 appear at 14 F. R. 3552.

§ 295.1 *Definitions.* (a) A noncertificated cargo carrier shall be defined to mean any air carrier which directly engages in interstate or overseas air transportation of property only and which on May 5, 1947:

(1) Did not hold a certificate of public convenience and necessity under section 401 of the Civil Aeronautics Act of 1938, as amended;

(2) Had on file with the Board an application for a certificate of public convenience and necessity authorizing scheduled interstate or overseas air transportation of property only; and

(3) Was actively engaged in the business of carrying property by air for compensation or hire.

(b) For the purpose of this part, the term "established points" shall be defined for any given noncertificated cargo carrier to include any point to or from which such carrier has transported property by air, for compensation or hire, on other than merely a casual, occasional, or infrequent basis, at any time during the 12-month period ending May 5, 1947: *Provided, however,* That such point is a point, or is located in a region, proposed to be served in such carrier's pending application referred to in paragraph (a) (2).

§ 295.2 *Applicability.* This part shall not apply to any air carrier authorized by a certificate of public convenience and necessity to engage in air transportation, to Alaskan air carriers, to operations within Alaska, or to any noncertificated air carrier engaged in air transportation pursuant to special or individual exemption by the Board, or pursuant to exemption created by any other part of this subchapter.

§ 295.3 *Classification.* There is hereby established a classification of noncertificated air carriers to be designated as noncertificated cargo carriers.

§ 295.4 *Scope of operations affected.* (a) Except as otherwise provided in this part, each noncertificated cargo carrier shall be entitled to the exemptions created by this part only with respect to transportation between such carrier's "established points."

(b) Upon filing written notice with the Board of intention to serve any other point located within the area immediately adjacent to any established point, such carrier also shall be entitled to the exemptions created by this part with respect to transportation to or from such other point unless and until the Board shall advise the carrier that such other point is not deemed, with reference to the purposes of this part, to be located within said immediately adjacent area, or that said transportation to or from such other point is not in the public interest.

§ 295.5 *Duration of exemption.* Unless otherwise extended as to any particular carrier by appropriate order of the Board, the exemptions provided in this part shall apply to each noncertificated cargo carrier only until 60 days after the Board shall have made final disposition of any one application, or part thereof, on file with the Board by that carrier on May 5, 1947, for a certificate of public convenience and necessity authorizing the direct scheduled interstate or overseas air transportation of property only.

§ 295.6 *Exemptions.* Except as otherwise provided in this part, noncertified cargo carriers shall be exempt from all provisions of Title IV of the Civil Aeronautics Act of 1938, as amended, other than the following:

(1) Subsection 401 (l) (Compliance with Labor Legislation);

(2) Section 403 (Tariffs);

(3) Subsection 404 (a) (Carrier's Duty to Provide Service, etc.), only insofar as said subsection requires air carriers to provide safe service, equipment, and facilities in connection with air transportation, and to establish, observe, and enforce just and reasonable individual and joint rates, fares, and charges, and just, reasonable, and equitable divisions thereof, and just, reasonable classifications, rules, regulations, and practices relating to air transportation;

(4) Subsection 404 (b) (Discrimination);

(5) Subsection 407 (a) (Filing of Reports): *Provided*, That no provision of any rule, regulation, term, condition, or limitation prescribed pursuant to said subsection 407 (a) shall be applicable to noncertificated cargo carriers unless such rule, regulation, term, condition, or limitation expressly so provides;

(6) Subsection 407 (b) (Disclosure of Stock Ownership);

(7) Subsection 407 (c) (Disclosure of Stock Ownership by Officers or Directors);

(8) Subsection 407 (d) (Form of Accounts); *Provided*, That no provision of any rule, regulation, term, condition, or limitation prescribed pursuant to said subsection 407 (d) shall be applicable to noncertificated cargo carriers unless such rule, regulation, term, condition, or limitation expressly so provides;

(9) Subsection 407 (e) (Inspection of Accounts and Property);

(10) Section 408 (Consolidation, Merger, and Acquisition of Control);

(11) Subsection 409 (a) (Interlocking Relationships);

(12) Subsection 409 (b) (Profit from Transfer of Securities);

(13) Section 410 (Loans and Financial Aid);

(14) Section 411 (Methods of Competition);

(15) Section 412 (Pooling and Other Agreements): *Provided*, That noncertificated cargo carriers shall be exempt from said section 412 until 60 days after June 10, 1947: *Provided further*, That such exemption from said section 412 shall not constitute an order made under said section, within the meaning of section 414, and shall not confer any immunity or relief from operations of the "antitrust" laws, or any other statute (except the Civil Aeronautics Act of 1938, as amended), with respect to any contract or agreement otherwise within the purview of said section 412;

(16) Section 413 (Form of Control);

(17) Section 414 (Legal Restraints);

(18) Section 415 (Inquiry into Air Carrier Management);

(19) Section 416 (Classification and Exemption of Carriers).

§ 295.7 *Registration for exemption.* From and after 60 days after June 10, 1947 no noncertificated cargo carrier may engage in any form of air transportation unless there is then outstanding and in effect with respect to such air carrier a letter of registration issued by the Board; *Provided*, That if any noncertificated cargo carrier, otherwise authorized to engage in air transportation pursuant to this section, shall file with the Board, within 60 days after June 10, 1947, an application for a letter of registration, such applicant may engage in such air transportation until such letter has been issued or such applicant has been notified that it appears to the Board that such applicant is not entitled to the issuance of such letter.

§ 295.8 *Issuance of letter of registration.* Upon the filing, in duplicate, of proper application therefor, the Board shall issue, to any noncertificated cargo carrier, a letter of registration which, unless otherwise sooner rendered ineffective, shall expire and be of no further force and effect, upon a finding by the Board that enforcement of the provisions of section 401 (from which exemption is provided in this section) would be in the public interest and would no longer be an undue burden on such noncertificated cargo carrier or class of noncertificated cargo carriers. Such application shall be certified to by a responsible official of such carrier as being correct, and shall contain the following information:

(a) Date;

(b) Name of carrier;

(c) Mailing address;

(d) Location of principal operating base;

(e) If a corporation, the place of incorporation, the name and citizenship of officers and directors, the name and address of each stockholder owning beneficially more than 5 percent of the voting interest, and a statement that at least 75 per centum of the voting interest is owned or controlled by persons who are citizens of the United States or of one of its possessions;

(f) If an individual or partnership, the name and citizenship of owners or partners;

(g) Reference, by date of filing and docket number, to pending applications for certificates of public convenience and necessity for interstate or overseas air transportation of property only, filed with the Board prior to May 5, 1947; and

(h) List of the carrier's established points, showing, as to each such point, the maximum number of its flights serving such point in any 1 month during the 12-month period ending May 5, 1947.

§ 295.9 *Nontransferability of letter of registration.* Letters of registration shall be nontransferable and shall be effective only with respect to the person named therein.

§ 295.10 *Suspension of letter of registration.* Letters of registration shall be subject to immediate suspension when, in the opinion of the Board, such action is required in the public interest.

§ 295.11 *Revocation of letter of registration.* Letters of registration shall be subject to revocation, after notice and hearing, for knowing and willful violation of any provision of the Civil Aeronautics Act of 1938, as amended, or of any order, rule, or regulation issued under any such provision, or of any term, condition, or limitation of any authority issued under said act or regulations.

§ 295.12 *Separability.* If any provision of this part or the application thereof, to any air transportation, person, class of persons, or circumstance is held invalid, the remainder of the part and the application of such provisions to other air transportation, persons, classes of persons, or circumstances shall not be affected thereby.

PART 296—CLASSIFICATION AND EXEMPTION OF AIR FREIGHT FORWARDERS

AUTHORITY: §§ 296.1 to 296.18 issued under sec. 205 (a); 52 Stat. 984, 49 U. S. C. 425. Interpret or apply sec. 1, (2), 416; 52 Stat. 977, 1004; 49 U. S. C. 401, 496.

SOURCE: §§ 296.1 to 296.18 appear at 14 F. R. 3553.

§ 296.1 *Definitions.* An air freight forwarder shall be defined to mean any person which engages indirectly in air transportation of property only, and which, in the ordinary and usual course of his undertaking, (a) assembles and consolidates or provides for assembling and consolidating such property and performs or provides for the performance of break-bulk and distributing operations with respect to such consolidated shipments, (b) assumes responsibility for the transportation of such property from the point of receipt to point of destination, and (c) utilizes for the whole or any part of the transportation of such shipments, the services of a direct air carrier subject to the act.

§ 296.2 *Classification.* There is hereby established a classification of air carriers which are not directly engaged in the operation of aircraft in air transportation (herein referred to as "indirect air carriers") to be designated as "air freight forwarders."

§ 296.3 *Exemption.* Subject to the other provisions of this part, air freight forwarders are hereby relieved from the provisions of Title VI of the act, and from all provisions of Title IV of the act, other than the following:

(a) Subsecton 401 (l) (Compliance with Labor Legislation);

(b) Section 403 (Tariffs);

(c) Subsection 404 (a) (Carrier's Duty to Provide Service, etc.), insofar as said subsection requires air carriers to provide safe service, equipment and facilities in connection with air transportation, and to establish, observe, and enforce just and reasonable individual rates, fares, and charges, and just and reasonable classifications, rules, regulations, and practices relating to air transportation;

(d) Subsection 404 (b) (Discrimination);

(e) Subsection 407 (a) (Filing of Reports); *Provided,* That no provision of any rule, regulation, term, condition, or limitation prescribed pursuant to said subsection 407 (a) shall be applicable to air freight forwarders unless such rule, regulation, term, condition, or limitation expressly so provides;

(f) Subsection 407 (b) (Disclosure of Stock Ownership);

(g) Subsection 407 (c) (Disclosure of Stock Ownership by Officers or Directors);

(h) Subsection 407 (d) (Form of Accounts); *Provided,* That no provision of any rule, regulation, term, condition, or limitation prescribed pursuant to said subsection 407 (d) shall be applicable to air freight forwarders unless such rule, regulation, term, condition, or limitation expressly so provides;

(i) Subsection 407 (e) (Inspection of Accounts and Property);

(j) Section 408 (Consolidation, Merger and Acquisition of Control);

(k) Section 409 (Prohibited Interests);

(l) Section 410 (Loans and Financial Aid);

(m) Section 411 (Methods of Competition);

(n) Section 412 (Pooling and Other Agreements);

(o) Section 413 (Form of Control);

(p) Section 414 (Legal Restraints);

(q) Section 415 (Inquiry into Air Carrier Management); and

(r) Section 416 (Classification and Exemption of Carriers).

§ 296.4 *Duration.* The temporary authority provided by this part shall continue in effect until such time as the Board shall find that the exemption accorded herein is no longer in the public interest, but in no event longer than 5 years from October 15, 1948.

§ 296.5 *Limitation*—(a) *Use of aircraft.* In respect to operations conducted pursuant to the authority provided in this part no air freight forwarder shall ship property by air except upon aircraft operated in common carriage (1) by small irregular carriers (as defined in Part 291 of this chapter), or (2) by air carriers whose tariffs for the transportation services thus utilized have been filed with the Board.

(b) *Prohibition.* No freight forwarder shall ship property as an air carrier in air transportation except between places in the continental United States.

§ 296.6 *Necessity for letter of registration.* No person shall engage in air transportation pursuant to the exemption granted by this part unless there is in force with respect to such person a letter of registration issued by the Board.

§ 296.7 *Application for letter of registration.* Any person other than those specified in § 296.17 desiring to engage in operations as an air freight forwarder may apply to the Board for a letter of registration authorizing the conduct of such operations. Such application shall be submitted in duplicate in letter form, shall be certified to by a responsible official of such carrier as being correct, and shall contain the following information: (a) date; (b) name of air freight forwarder; (c) mailing address; (d) location of principal office; (e) if a corporation, the state of incorporation, the name and citizenship of officers and directors, and a statement that at least 75 percent of the voting interest is owned or controlled by persons who are citizens of the United States or one of its possessions; (f) the names of the largest stockholders, not exceeding 20, who hold, individually, 1 percent or more of the voting capital stock of the applicant; (g) if an individual or partnership, the name and citizenship of the owner or partners, and a statement of the respective interests of each; (h) a financial statement showing assets and liabilities as of a date not exceeding 6 months prior to the date of filing the application, and a statement showing the types and amounts of insurance, which is in force for the protection of the forwarder's customers, and the public and the name or names of the insurers; (i) whether or not any of the persons required to be listed under (e), (f), and (g) above has at any time been issued, either in his own name or some other name, any letter of registration or other license or operating authority by the Board, either as an irregular air carrier or air freight forwarder or otherwise, or is, or has been, affiliated as owner, partner, officer, director, or stockholder holding a controlling interest, with any other air carrier or carriers, either certificated or noncertificated, direct or indirect, together with the names of such other air carrier or carriers; (j) the information required in a "Report of Ownership of Stock" (CAB Form 2786; available from the Board's Publications Section) with respect to each officer and director, if a corporation or association; with respect to each partner or member, if a partnership; or with respect to the owner where the business is conducted by an individual; (k) such other additional information pertinent to applicant's activities as may be requested by the Board with respect to any individual application.

§ 296.8 *Issuance of letter of registration.* (a) If, after the filing of an application for a letter of registration it appears that the conduct of air freight forwarder operations by the applicant will not be inconsistent with the public interest the applicant will be notified and advised that upon the filing of a valid tariff a letter of registration will be issued to such applicant. Subject to the restrictions provided herein, and upon the receipt by the Board of such a valid tariff, a Letter of Registration shall forthwith be issued to the applicant. If it appears that the granting of such letter may not be consistent with the public interest, the Board shall notify the applicant of its findings in this respect and will inform the applicant by letter that the Board does not believe that the applicant has made a proper showing of public interest. Thereupon applicant may file with the Board a petition for leave to withdraw the application, or may request that the application be assigned for hearing, or may submit, within such reasonable time as may be established by the Board, such additional information as applicant believes will result in a showing of public interest.

(b) In the event additional information is submitted, the Board on its own initiative, may assign the application for hearing or without notice of hearing enter an order of approval or an order of disapproval in accordance with its determination of the public interest.

§ 296.9 *Effective period.* Each letter of registration shall become effective only upon the date specified therein and shall continue in effect until suspended or revoked, or during such period as the authority provided by this part shall remain in effect.

§ 296.10 *Restrictions on issuance of letter of registration.* No letter of registration will be issued to any freight forwarder which has, or proposes to have, as owner, partner, officer, director, or stockholder holding a controlling interest, any person who is or has been connected in any such capacity with any other air freight forwarder, irregular air carrier, or noncertificated cargo carriers, if such fowarder or carrier was subject to suspension action by the Board at the time of such connection, unless the Board finds that the public interest and applicant's intention and ability to conform to the provisions of the Act and requirements thereunder are not adversely affected by such relationship or former relationship. A forwarder or carrier shall be considered to be subject to suspension action within the meaning of this provision if it conducts unauthorized operations which subsequently form the basis for Board action looking toward the revocation or suspension of its letter of registration.

§ 296.11 *Conditions of a letter of registration.* No air freight forwarder shall have and retain, as an owner, partner, officer, director, or stockholder holding a controlling interest, any person who was, or is, affiliated in any of said capacities with any other air freight forwarder, irregular air carrier, or noncertificated cargo carrier under the circumstances set forth in § 296.10 unless it has been shown to the Board by such air freight forwarder, irregular air carrier, or noncertificated cargo carrier, and the Board finds that the public interest and the carrier's intention and ability to conform to the provisions of the act and requirements thereunder will not be adversely affected thereby.

§ 296.12 *Nontransferability of letter of registration.* A letter of registration shall be nontransferable and shall be effective only with respect to the person named therein.

§ 296.13 *Suspension of letter of registration.* Letters of registration shall be subject to immediate suspension when, in the opinion of the Board, such action is required in the public interest. Letters of registration shall be further subject to suspension upon complaint, or upon motion of any person showing an interest therein, or upon the Board's own initiative, after not less than 10 days' notice to the air freight forwarder, but without hearing or further proceedings, for failure to comply with the provisions of the act or with any order, rule or regulation issued thereunder, or with any term, condition or limitation of any authority issued thereunder. Such suspension shall continue until the Board finds that such suspended air freight forwarder has complied with the provisions of the act, or with such rules, regulations, orders, terms, conditions, or limitations. Failure to seek reinstatement of a letter of registration suspended pursuant to the provisions of this section within a period of 60 days after the effective date of such suspension shall automatically terminate all rights under such letter of registration.

§ 296.14 *Revocation of letter of registration.* (a) Letters of registration shall be subject to revocation, after notice and hearing, for knowing and willful violation of any provision of the act or of any order, rule, or regulation issued under any such provision, or of any term, condition, or limitation of any authority issued under said act or regulations.

(b) A letter of registration shall be revoked without prejudice upon the filing by an air freight forwarder of a written notice with the Board indicating the discontinuance of common carrier activities, together with a tender of the letter of registration for cancellation; *Provided*, That the Board may refuse to accept such notice or to cancel the letter if any proceeding or action is pending in which an air freight forwarder's authority may be subject to suspension or revocation action. The failure of any air freight forwarder, for two successive periods, to file the periodic reports required by this subchapter, may, for the purpose of this part, be deemed by the Board to constitute the filing of such written notice indicating the discontinuance of the common carrier activities, and in such case the tender of the letter of registration shall not be necessary.

§ 296.15 *Insurance*—(a) *Cargo.* No air freight forwarder shall engage in air transportation pursuant to this part unless the risks of loss of or damage to the property so transported by it are covered in the amounts prescribed in paragraph (c) of this section by insurance, a self-insurance fund or reserve, or surety bond.

(b) *Public liability and property damage.* No air freight forwarder shall engage in the performance of transfer, collection, or delivery services under the provisions of this section unless risks of bodily injury or death to persons or of damage to property (other than property covered by paragraph (a) of this section), resulting from the negligent operation, maintenance, or use of motor vehicles operated by it or under its direction and control, or resulting from other acts of its agents, employees and representatives in the performance of such transfer, collection, or delivery services are covered to the extent that legal liability may ensue, in the amounts prescribed in paragraphs (c) (2) and (3) of this section by insurance, a self-insurance fund or reserve, or surety bond.

(c) *Liability limits*—(1) *Cargo insurance.* For loss of or damage to property while carried on or resting in any one conveyance: $2,000.

(2) *Public liability; property.* For loss or damage to property occurring at any one time or place: $2,000.

(3) *Public liability; personal injury.* Claims for bodily injury or death: $10,000; for one person subject to that limit per person and for all persons in any one accident: $20,000.

§ 296.16 *Payment of transportation charges.* Freight bills from direct air carriers for all transportation charges shall be paid by every air freight forwarder within a reasonable period after the rendering of the transportation services. A reasonable maximum period for the payment of such charges shall be 7 days after being billed therefor.

§ 296.17 *Nonapplicability.* This section shall not apply (a) to any air carrier authorized by a certificate of public convenience and necessity to engage in air transportation, nor (b) to any noncertificated air carrier engaged in air transportation pursuant to any special or individual exemption order granted by the Board, nor (c) to any noncertificated air carrier engaged in air transportation pursuant to any general exemption granted by any other part of this subchapter.

§ 296.18 *Separability.* If any provision of this part or the application thereof to any air transportation, person, class of persons, or circumstance is held invalid, the remainder of the part and the application of such provisions to other air transportation, persons, classes of persons, or circumstances shall not be affected thereby.

Subchapter C—Procedural Regulations

PART 301—RULES OF PRACTICE IN AIR SAFETY PROCEEDINGS

NOTE: The Rules of Practice in Air Safety Proceedings currently in effect may be found in Part 97 of this chapter. For proposed revision of Part 97, to be designated Part 301 when adopted, see 14 F. R. 2574.

PART 302—RULES OF PRACTICE IN ECONOMIC PROCEEDINGS

AUTHORITY: §§ 302.1 to 302.17 issued under sec. 205 (a), 52 Stat. 984; 49 U. S. C. 425 (a). Interpret or apply secs. 1001, 1002, 52 Stat. 1017, 1018, as amended; 49 U. S. C. 641, 642.

SOURCE: §§ 302.1 to 302.17, contained in Regulations Serial No. 374, 11 F. R. 177A-351, as redesignated at 14 F. R. 3522, except as noted following section affected.

§ 302.1 *Proceedings.* There shall be one form of formal proceeding (to be known as a "proceeding") under Title IV and section 1002 of the act.

A proceeding may be instituted (a) by order to show cause or other process of the Board, (b) by the filing with the Board of a formal application, complaint or petition.

§ 302.2 *General requirements as to papers in proceedings*—(a) *Content of documents.* Any person wishing to institute a proceeding should consult the rules, regulations and orders of the Board under the various sections of the act. In case there is no rule, regulation or order of the Board which prescribes the contents of the formal application, complaint or petition in a given case, the application, complaint or petition should contain a proper identification of the parties concerned, a reference to the statutory authority under which the document is filed, and a concise but complete statement of the facts relied upon and the relief sought.

(b) *Insufficient allegations.* In any case where the Board is of the opinion that a formal application, complaint or petition does not sufficiently set forth the material required to be set forth by any applicable rule, regulation or order of the Board, or is otherwise insufficient, the Board may advise the party filing the same of the deficiency and require that any additional information be supplied by amendment.

(c) *Answers.* Answers to formal complaints, petitions and orders to show cause will not usually be required. In case an answer is deemed desirable, the parties will be notified. The issues of the proceeding will ordinarily be formulated at the prehearing conference.

(d) *Retention of papers by the Board.* When any formal application, complaint or petition is denied, dismissed or permitted to be withdrawn, in whole or in part, said application, complaint or petition, and all documents filed with the Board pertaining thereto shall be retained in the files of the Board. When any proceeding instituted by the Board is dismissed, terminated or rescinded, all documents filed with the Board pertaining thereto shall be retained in the files of the Board: *Provided,* That this paragraph shall not apply to documents filed with the Board in any proceeding on the basis of a stipulation that such documents will be returned to the parties so filing when the purpose for which the documents are filed has been served: *And provided further,* That the Board in its discretion may permit the withdrawal of original documents upon the submission of properly authenticated copies to replace such documents.

§ 302.3 *Form and filing of documents—*(a) *Execution, number of copies and service.* Unless otherwise required by applicable rule or regulation, every application, petition and formal complaint relating to any of the provisions of Title IV or section 1002 of the act, and every answer or other formal document in any such proceeding shall be signed by, or on behalf of, the person filing the same, and shall be verified by the person signing the same, in the manner required by paragraph (b) of this section. Proposed findings and conclusions or exceptions and supporting reasons therefor shall be signed but need not be verified. Any general partner may sign on behalf of a partnership. Documents filed by a corporation, business trust or other similar organization must be signed by an officer who is duly authorized to take such action. An executed original copy of each such document, and nineteen true copies thereof, which need not be signed or verified, but which should have typed or facsimile signatures, shall be filed with the Board. Each person filing any such document shall furnish such additional copies and shall make such service of the document on other persons as the Board may at any time require. Such documents shall be delivered in person, through the mails, or otherwise, to the Civil Aeronautics Board in Washington, D. C., and shall be deemed to have been filed on the date on which they are actually received by the Board.

(b) *Verification.* Every verification shall set forth that the person verifying the document has read and is familiar with the contents thereof and the attached exhibits, if any; that he intends and desires that in granting or denying the relief requested, the Board shall place full and complete reliance upon the accuracy of each and every statement therein contained; that he is familiar with the facts therein set forth; that to the best of his information and belief, every statement contained in the instrument is true and no such statement is misleading.

(c) *Formal specifications of papers.* All papers filed in proceedings should be on strong, durable paper not larger than $8\frac{1}{2}$ by 13 inches in size except that tables, charts and other documents may be larger, folded to approximately that size. The left margin should be at least $1\frac{1}{2}$ inches wide and, if the document is bound, it should be bound on the left side.

Papers may be reproduced by printing or by any other process, provided the copies are clear and legible. Appropriate notes or other indications should be used, so that the existence of deficits and any other matters normally shown in color will be accurately indicated on photostatic copies.

(d) *Waiver of strict compliance with rule.* The Board may, in its discretion, waive strict compliance with any requirement of this section.

§ 302.4 *Appearances and practice requirements—*(a) *Appearances.* Any party to a proceeding may appear and be heard in such proceeding in person or by attorney. So far as the orderly conduct of business permits, any person may appear and be heard in person or by attorney before the Board or its officers and employees for the presentation, adjustment, or determination of any issue, request or controversy in any proceeding or in connection with any function of the Board.

(b) *Practice requirements.* No register of attorneys who may practice before the Board is maintained and no application for admission to practice is required. Any attorney practicing before the Board or desiring so to practice may, for good cause shown, be disbarred or suspended from so practicing, but only after he has been afforded an opportunity to be heard in the matter.

§ 302.5 *Subpoenas and depositions—*(a) *Subpoenas.* Subpoenas requiring the attendance and testimony of witnesses and the production of books, papers and documents relating to any matter under investigation, may be issued by any member of the Board or any person designated as Examiner in any proceeding or investigation. Application therefor may be made either to the Secretary of the Board or to the Examiner. Such application must be in writing and should specify as exactly as possible the competency, relevancy, and materiality of the evidence sought, and should describe in detail the documents desired.

(b) *Depositions.* Any party desiring to take the deposition of a witness shall make application in writing to the Secretary of the Board or the Examiner in the proceeding or investigation, stating the reasons why such deposition should be taken, the name of the witness, the time and place for taking of such deposition, and a general description of the matter or matters concerning which testimony is requested, or a list of questions or interrogatories to be propounded. Such application shall be accompanied by a proof of service upon all parties to the proceeding. If good cause be shown, an order will be issued authorizing such deposition and specifying the time and place, the subject matter to be covered, and designating, by name or otherwise, the person before whom such deposition is to be taken. After the deposition has been reduced to writing and properly certified, the original and two copies thereof shall be forwarded to the Board at its office in Washington, D. C., where, unless otherwise ordered by the Board for good cause shown, it shall be filed in the record in said proceeding or investigation. Depositions shall conform to the requirements of formal specifications of papers contained in § 302.3.

§ 302.6 *Appearances by third persons and formal interventions—*(a) *Appearances by third persons.* Any person, including any State, political subdivision thereof, State aviation commission, or other public body, may appear at any hearing and present any evidence which is relevant to the issues. Such persons may also suggest questions or interrogatories to be propounded by public counsel to witnesses called by other persons. With the consent of the examiner, or of the Board, if the hearing is held before the Board, such persons may also cross-examine witnesses directly.

(b) *Formal interventions.* (1) Any person having a substantial interest in the subject matter of any proceeding may petition for leave to intervene in such proceeding and may become a party thereto upon compliance with the provisions of this paragraph. In general, such petitions will not be granted unless it shall be found:

(i) That such person has a statutory right to be made a party to such proceeding; or,

(ii) That such person will or may be bound by the order to be entered in the proceeding; or,

(iii) That such person has a property or financial interest which may not be adequately represented by existing parties, if such intervention would not unduly broaden the issues or delay the proceeding.

However, the denial of such a petition for leave to intervene shall not prevent the petitioner from participating in the proceeding in the manner described in paragraph (a) of this section.

(2) Unless otherwise ordered by the Board every petition for leave to inter-

vene shall be filed with the Board prior to the first prehearing conference, or in the event that no such conference is to be held, not later than 10 days prior to the hearing. Copies of the petition shall be mailed or delivered to each party to the proceeding prior to the filing of the petition. The Board, however, may pass upon any such petition without receiving testimony or argument either from the petitioner or from other parties to the proceeding. The petition shall clearly set forth the interest of the petitioner, and shall otherwise comply with the requirements of § 302.3.

(3) No petition for leave to intervene, not filed within the time limited by subparagraph (2) of this paragraph, will be entertained unless the petitioner shall clearly show good cause for his failure to file such petition within the time so limited. In the event that such petition is heard by an examiner, his determination shall be governed by the standards set forth in this section, but no decision by an examiner on such petition shall be binding on the Board. Interventions provided in this section are for administrative purposes, and no decision to grant leave to intervene shall be deemed to constitute a finding or determination that the intervening party has such a substantial interest in the order that is to be entered in that proceeding as will entitle it to demand court review of such order.

§ 302.7 *Conference procedure*—(a) *Purpose.* In any proceeding, the examiner or any other person designated for the purpose of this section will, unless otherwise ordered by the Board, direct counsel for the parties to such proceeding to appear before him for a conference to consider the following:

(1) The formulation of the issues to be considered at the hearing by:

(i) Agreement of the parties,

(ii) Amendment of the application, complaint, or petition,

(iii) Any other appropriate means;

(2) The position of all parties with respect to the issues so formulated. Unless responsive pleading is required by order of the Board it is intended that the position stated at the conference shall serve in lieu of formal answer or notice of issues controverted in fact or law. The person conducting the conference may order further conference to accomplish this purpose, or may require responsive pleadings from any party failing to give notice at the conference of its position respecting the issues.

(3) The simplification of proof by:

(i) Stipulations concerning matters of which the Board can take notice, the admission in evidence of particular facts or documents or any other appropriate matter,

(ii) Limitation of the number of witnesses,

(iii) The preparation of exhibits, and the use thereof in lieu of oral testimony whenever possible,

(iv) Any other appropriate means;

(4) The exchange prior to the date of the hearing of exhibits proposed to be introduced therein and any other material which will expedite the conduct of the same; and

(5) Such other matters as may, in the opinion of the person conducting the conference, aid in the conduct and disposition of the proceeding.

(b) *Notice.* Notice of the time and place of the conference shall be given by letter or otherwise to all parties to the proceeding.

(c) *Exchange of exhibits.* The person conducting the conference may require exchange of exhibits before the date set for the hearing, and if any exhibits are not exchanged in advance as required, or as agreed upon by counsel at the conference, the hearing shall be subject to postponement until such exchange is completed.

(d) *Conference report.* The person conducting the conference shall prepare a report of the same; which shall be served upon counsel for all of the parties and made of record. Counsel may object to the description of anything which occurred at the conference within five days after the receipt of the report, and such report may, in the discretion of the person preparing the same, be revised in accordance therewith. If revised, the report shall again be served upon counsel and made of record in the same manner as the original report. Exceptions may be taken on the basis of any written objection submitted within the time prescribed which has not been met by a revision of the report. Such report shall constitute the official account of all that transpired at the conference and shall control the subsequent course of the proceeding, but it may be reconsidered and modified at any time to prevent injustice.

§ 302.8 *Hearings, argument, recommended decisions, and proceedings subsequent thereto*—(a) *Oral argument before examiner, proposed findings and conclusions and supporting reasons therefor.* (1) Upon request of any party, an examiner may permit oral argument at the close of the hearing. Oral argument shall be transcribed, but shall not constitute part of the record.

(2) After the close of the hearing, and within the time announced by the Examiner, the parties may submit proposed findings and conclusions and supporting reasons therefor.

(b) *Transcript of hearings and corrections thereto.* (1) Hearings shall be recorded and transcribed by a contract reporter of the Board under supervision of the examiner. Copies of the transcript will be supplied to the parties to the proceeding by the reporter at rates not to exceed the maximum rates fixed by contract between the Board and the reporter.

(2) Changes in the official transcript may be made only when they involve errors affecting substance. Lists of proposed corrections shall be filed with the examiner together with proof of service upon other parties to the proceeding within ten days after receipt of the completed transcript by the Board. If no objections to the proposed corrections are received within ten days after proof of such service, the transcript will, upon the approval of the examiner, be changed to reflect such corrections. If exceptions are received, the proposed corrections will be submitted to the official reporter for comparison with the stenographic record of the hearing. If such record indicates that the transcript is in error, it will be corrected. If the reporter states that the transcript is correct, the request for corrections will be denied.

(c) *Recommended decisions.* In each proceeding heard before an examiner, other than proceedings for the determination of rates, fares or charges, or the determination of compensation for the transportation of mail, unless the Board shall by order in the particular proceeding require the entire record to be certified to it for initial decision, the examiner shall recommend a decision. The examiner will also announce, or state in his recommended decision:

(1) The names of the persons who are to receive copies of the same;

(2) The time within which exceptions are to be filed and exchanged; and

(3) The time thereafter within which supporting reasons relating to such exceptions are to be filed and exchanged, and may give other instructions relating to procedure after the hearing.

(d) *Exceptions to recommended decisions and supporting reasons therefor.* (1) Any party to the proceeding may take exceptions to the recommended decision. Exceptions to findings of fact shall designate, by exact and specific reference, the portions of the record which will be relied upon in support of such exceptions. Exceptions to conclusions of law shall briefly cite the statutory provisions or the principal authorities that will be relied upon in support of the exceptions to the conclusions of law.

(2) After the filing and exchange of exceptions, each party should prepare a single statement supporting its own exceptions and covering any points which it wishes to raise in connection with exceptions filed by others. Exceptions and supporting reasons therefor shall be filed with the Board and not with the Examiner.

(e) *Service and form of proposed findings and conclusions, exceptions and supporting reasons, postponement of date.* (1) Each set of proposed findings and conclusions, exceptions, and reasons in support thereof shall when filed, be accompanied by a proof of service thereof by mail upon all parties to the proceedings and upon such other persons designated by the examiner to receive copies of the report.

(2) Except by special permission of the Board, briefs shall not exceed fifty pages in length and reply briefs will not be received. The number of copies to be filed is governed by § 302.3 (a).

(3) After a date has been set for the submission of proposed findings or conclusions and reasons in support thereof to the examiner, or the filing of exceptions to the recommended decision and supporting reasons therefor, such date may be postponed upon proper cause shown, but any such postponement shall not be granted by the examiner less than three days prior to the date originally set for the filing thereof except in cases involving unusual circumstances imposing substantial hardship upon the requesting party or parties.

(f) *Oral argument before the Board.* If any person desires to argue a case orally before the Board he must request leave of the Board to make such argument. Such request should be filed with the briefs for the Board in the proceeding. The Board will advise the persons making such request as to its decision and if such argument is to be allowed all persons who have filed briefs in the proceedings will be advised of the date and hour set for such argument and the amount of time allowed to each such person.

§ 302.9 *Exhibits*—(a) *Copies.* Wherever practicable, one copy of each exhibit (in addition to the original offered in evidence at the hearing) should be furnished for the use of each examiner and two copies should be furnished to Public Counsel. One of such copies will be made available for inspection by all persons present at the hearing. One copy should also be furnished to each party and the examiner may, in his discretion, direct that any other person deemed by him to have sufficient interest shall receive copies of designated exhibits.

(b) *Excerpts from other documents.* Excerpts from lengthy documents or of portions of the record in other proceedings before the Board should be offered in the form of exhibits and copies furnished as above provided. Such exhibits may be received in evidence, subject to objection and rebuttal by Public Counsel or other counsel, after opportunity to examine the exhibit in question and the source from which the same was taken.

§ 302.10 *Hearings before the Board and before Boards of Examiners.* Provisions of this part governing the conduct of hearings before single examiners shall also govern, with necessary changes, in cases where such hearings are held before the Board, a member thereof, or a Board of more than one examiner.

§ 302.11 *Petition for rehearing, reargument, or reconsideration*—(a) *Parties.* Any party may petition for rehearing, reargument, or reconsideration of any final order by the Board in a proceeding, or for further hearing before decision by the Board.

(b) *Contents of petitions.* (1) The matters of record claimed to have been erroneously decided must be specified, and the alleged errors, and the grounds relied upon must be briefly and specifically stated in the petition.

(2) If a final order of the Board is sought to be vacated or modified by reason of matters which have arisen since the hearing, or of a consequence which would result from a compliance therewith, or both, the new matter, the resulting consequence, or both, which are relied upon by the petitioner must each be set forth in the petition. Where the petition is based wholly or in part upon new matter, the petition must contain a statement that the petitioner, with due diligence, could not have known or discovered the new matter prior to the time of the hearing.

(3) The petition must set forth a brief statement of the relief sought by the petitioner and conform to requirements of § 302.3.

(c) *Filing and service of petitions.* Such petition for rehearing, reargument, or reconsideration, must be filed within thirty days after service of the order sought to be vacated or modified. After the expiration of said thirty days, such a petition may be filed only by leave of the Board granted pursuant to formal application upon a showing of reasonable grounds for failure to file the petition within the prescribed thirty-day period. Any such petition or application shall be served by the petitioner or applicant upon all parties to the proceeding or their attorneys of record.

(d) *Stay of orders.* No petition for rehearing, reargument, or reconsideration filed in accordance with this section, or the granting thereof, shall operate as a stay of the effective date of the final order sought to be modified or vacated by such petition, unless specifically so ordered by the Board.

§ 302.12 *Memoranda in opposition or support.* Each protest or memorandum of opposition to or in support of the issuance, alteration, amendment, modification, suspension, revocation or abandonment of a certificate of public convenience and necessity or of a foreign air carrier permit which is desired to be filed with the Board pursuant to the provisions of section 401 or 402 of the act, shall conform to the requirements of § 302.3 with respect to size, style and number of copies, shall be signed by the person filing it, and shall be acknowledged before a person authorized to administer oaths. Each such protest or memorandum shall clearly state on its face the particular proceeding in which it is desired to be filed and shall contain a concise but clear statement of the grounds of opposition or support. At the time of filing any such protest or memorandum with the Board, the person filing it shall serve a copy thereof upon each party to the particular proceeding and upon such other persons as the Board may require. No such protest or memorandum will be received as, or be considered to constitute, evidence in the particular proceeding of any fact mentioned or discussed therein. However, evidence in support of any such protest or memorandum may be presented by or on behalf of the person filing it in the manner provided in § 302.6 (a).

§ 302.13 *Procedure in rate proceedings*—(a) *Institution of proceedings.* Proceedings for the determination of rates of compensation for the transportation of mail may be commenced by the filing of a petition by an air carrier or the Postmaster General, or upon the issuance of an order by the Board. Proceedings for the determination of rates, fares, or charges for the transportation of passengers or property may be commenced by the filing of a complaint, the filing of a petition by an air carrier or upon issuance of an order by the Board.

(b) *Order setting tentative rates, fares or charges.* Proceedings commenced by the Board will normally be instituted by the issuance of an order directing the parties to show cause why specified rates, fares, or charges set out in such order should not be fixed and determined by the Board.

(1) In proceedings instituted upon petition or complaint, the Board, before further procedural steps are taken, will normally issue an order directing the parties to show cause why specified rates, fares, or charges set out in such order should not be fixed and determined by the Board.

(2) The rates, fares, or charges specified in any order issued pursuant to this section will represent tentative rates, fares, or charges which appear to the Board to be fair and reasonable on the basis of the carrier's monthly and annual reports and other information available to the Board. Such orders will be accompanied by and incorporate exhibits setting forth the basis upon which the tentative rates, fares, or charges have been formulated.

(3) Rules, orders and notices issued hereunder will be served upon the carrier concerned, and any other parties to the proceeding, and public notice thereof will be given. Copies of rules, orders and notices entered in proceedings for the determination of rates of compensation for the transportation of mail will be transmitted to the Postmaster General.

(c) *Objection and answer to order setting tentative rates, fares, or charges.* (1) After the issuance of an order of the Board pursuant to paragraph (b) of this section, any party having objections to the tentative rates, fares, or charges specified in such order or to the admissibility in evidence of the exhibits accompanying such order and information specified therein shall file with the Board, within such periods of time as may be prescribed in such order notice of the fact that such objections exist and, after such notice, a written answer setting out the objections of the party to the tentative rates, fares, or charges.

(2) Objections stated in an answer shall be specific, and the answer shall be accompanied by exhibits in support of the objections and by a statement of the effect of such objections upon the tentative rates, fares, or charges.

(d) *Procedure when no answer is filed to order setting tentative rates, fares, or charges.* (1) If no notice, or if after notice no answer, is filed as provided in paragraph (c) of this section within the periods of time prescribed in the order, the proceeding will be assigned for public hearing. The statutory public hearing thus assigned will be expected to require nothing more than the introduction in evidence of the exhibits provided for in paragraph (b) (2) of this section and the information specified therein.

(2) The Board, upon the close of such hearing, will adopt the tentative rates, fares, or charges specified in its order pursuant to paragraph (b) of this section as its tentative decision. If no exceptions are filed to such tentative decision within 10 days after such decision is published or made available to public inspection, such decision shall without further proceedings become the final decision of the Board.

(e) *Procedure when answer is filed to order setting tentative rates, fares, or charges.* (1) If an answer is filed as provided in paragraph (c) of this section a conference will be held. The conference will be attended by representatives of the

Board assigned to the particular case and representatives of the parties, and will be presided over by an examiner of the Board.

(2) If a party desires to introduce evidence in the proceeding he shall file written notice with the examiner at the time of such conference. If a party desires an opportunity to file proposed findings and conclusions with supporting reasons therefor, he shall file written notice thereof with the examiner not later than the close of the hearing provided for in this section. If a party desires an opportunity to present oral argument to the Board prior to issuance of a tentative decision, he shall file a written request therefor with the examiner not later than the close of the hearing provided for in this section.

(3) The examiner, at the close of the conference, will prepare and serve upon the parties a conference report stating the issues raised by the objections of the parties with respect to the tentative rates, fares, or charges. Any party may file exceptions to such report within such time as may be prescribed by the examiner.

(4) After service of the conference report, the proceeding will be assigned for public hearing before an examiner of the Board.

(5) The exhibits provided for in paragraph (b) (2) of this section and the information specified therein, and any exhibits filed by any party in support of any objections filed pursuant to paragraph (c) of this section shall constitute evidence of record in the proceeding, subject to the right of any party to object to the admissibility of such exhibits and information. Additional evidence may be presented by the parties at such hearing only if the notice provided for in paragraph (e) (2) of this section has been filed, and such evidence shall be limited to evidence relating to the issues as defined in the conference report issued by the examiner and exceptions filed thereto pursuant to paragraph (e) (3) of this section. A member (or members) of the Board's staff will be available at the hearing for examination by the parties on the evidence with respect to such issues.

(6) Upon the conclusion of the hearing and the filing of proposed findings and conclusions and reasons in support thereof, the examiner shall certify the entire record to the Board for a tentative decision.

(7) After certification of the record to the Board and completion of any oral argument, the Board will issue a tentative decision. Exceptions to a tentative decision and supporting reasons therefor may be filed within such time as may be prescribed in the tentative decision. Oral arguments to the Board on exceptions to tentative decisions will be permitted only in unusual and exceptional instances for good cause shown, and upon request set forth in the document containing the exceptions and supporting reasons.

(8) If no exceptions to a tentative decision are filed within the prescribed time, the tentative decision shall, without further proceedings, become the final decision of the Board. If exceptions are taken to a tentative decision and oral argument is not entertained, the proceeding will be deemed submitted to the Board for final decision upon the filing of exceptions by the parties, or upon the expiration of the prescribed time for exceptions, whichever first occurs. Proceedings in which oral argument on exceptions to the tentative decision is entertained, will be deemed submitted to the Board for final decision upon the completion of such oral argument.

§ 302.14 *Informal complaints.* Complaints, other than formal complaints, may be made in writing with respect to anything done or omitted to be done by any person in contravention of any provision of the act, or of any requirement established pursuant thereto. Matters so presented may, if their nature warrants, be taken up by correspondence or conference with the person or persons complained of. Any matter not disposed of informally may, in the discretion of the Board, be made the subject of a formal proceeding. The filing of an informal complaint shall not prohibit the subsequent filing of a formal complaint.

§ 302.15 *Formal complaints*—(a) *Form and content of formal complaints.* Formal complaints must conform to the requirements of this part concerning form and filing of documents in proceedings. They should be so drawn as fully and completely to advise the persons complained against and the Board in what respect anything has been done or omitted to be done in contravention of any provision of the act or of any requirement established pursuant thereto, the facts claimed to constitute such action or omission, and the relief sought. Formal complaints filed with the Board must be accompanied by a proof of service personally or by mail upon the person or persons complained against.

(b) *Satisfaction of formal complaints.* If the person complained against satisfies a complaint at any time prior to final action by the Board on such complaint, a statement to that effect must be filed setting forth when and how the complaint has been satisfied. Upon receipt of satisfactory evidence of settlement, the complaint may be dismissed in the discretion of the Board. Voluntary settlements are encouraged, and in furtherance of such settlement a representative of the Board may attempt settlement by means of correspondence or conference with the parties. No statement, admission or offer of settlement made pursuant to such correspondence or conference shall be admissible in evidence over the objection of either party in any formal proceeding before the Board concerning the complaint.

(c) *Complaints requesting suspension of tariffs.* (1) Formal complaints seeking suspensions of tariffs pursuant to section 1002 (g) of the act shall fully identify the tariff and include reference to the name of the publishing carrier or agent, to the CAB number, and to specific items or particular provisions protested or complained against. In addition to conforming to the requirements of paragraph (a) of this section, such complaint should indicate in what respect the tariff is considered to be unlawful, and state what complainant suggests by way of substitution.

(2) A complaint requesting suspension of any tariff filed under the act ordinarily will not be considered unless made in conformity with this section and filed with the Board at least ten days before the effective date of the tariff. In an emergency satisfactorily shown by complainant, and within the time limits herein provided, a telegraphic complaint may be sent to the Board and to the publishing carrier or agent stating the grounds relied upon, but such telegraphic complaint must immediately be confirmed by complaint filed and served in accordance with this section.

§ 302.16 *Objections to public disclosure of information*—(a) *Information contained in paper to be filed.* Any person who objects to the public disclosure of any information contained in any paper filed in any proceeding, or in any application, report, or other document filed pursuant to the provisions of the Civil Aeronautics Act of 1938, as amended, or any rule, regulation, or order of the Board thereunder, shall segregate, or request the segregation of, such information into a separate paper and shall file it, or request that it be filed, with the examiner or the person conducting the hearing or proceeding, as the case may be, or with the person with whom said application, report, or document is required to be filed, separately in a sealed envelope, bearing the caption of the enclosed paper and the notation "Confidential Information." At the time of filing such paper, or when the objection is made by a person not himself filing the paper, application, report, or other document, within five days after the filing of such paper, the objecting party shall file a motion to withhold the information from public disclosure, in accordance with the procedure outlined in paragraph (d) of this section, except as provided in paragraph (c) of this section. Notwithstanding any other provision of this section, copies of the filed paper and of the motion need not be served upon any other party unless so ordered by the Board.

(b) *Information contained in oral testimony.* Any person who objects to the public disclosure of any information sought to be elicited from a witness or deponent on oral examination shall, before such information is disclosed, make his objection known. Upon such objection duly made, the witness or deponent shall be compelled to disclose such information only in the presence of the examiner or the person before whom the deposition is being taken, as the case may be, the official stenographer and such attorneys for and lay representatives of each party as the examiner or person before whom the deposition is being taken, as the case may be, shall designate, and after all present have been sworn to secrecy. The transcript of testimony containing such information shall be segregated and filed in a sealed envelope, bearing the title and docket number of the proceeding, and the notation "Confidential Testimony Given by (name of witness or deponent)." Within 5 days after such testimony is given, the objecting person shall file a motion, except as hereinafter provided in paragraph (c) of this section, in accordance with the procedure outlined in paragraph (d) of this section, to withhold the information from public disclosure. Notwithstanding any other provision of this section, copies of the segregated portion of the transcript and of the motion need not be served upon any other party unless so ordered by the Board.

(c) *Objection by government departments or representatives thereof.* In the case of objection to the public disclosure of any information filed by or elicited from any government department, or representative thereof, under paragraphs (a) or (b) of this section, the department, or person representing said department, making such objection shall be exempted from the provisions of paragraphs (a), (b), and (d) of this section insofar as said paragraphs require the filing of a written objection to such disclosure. However, any department, or person representing said department, if it so desires, may file a memorandum setting forth the reasons on the basis of which it is claimed that a public disclosure of the information should not be made. If such a memorandum is submitted, it shall be filed and handled as is provided by this section in the case of a motion to withhold information from public disclosure.

(d) *Form of motion to withhold information from public disclosure.* Subject to the exception of paragraph (c), no information covered by paragraphs (a) and (b) of this section need be withheld from public disclosure unless written objection to such disclosure is filed with the Board in accordance with the following procedure:

(1) The motion shall be headed with the title and docket number of the proceeding and shall be signed and verified by the objecting person, any duly authorized officer or agent thereof, or by counsel representing such person in the proceeding.

(2) The motion shall include (i) a description of the information sought to be withheld, sufficient for identification of the same, and (ii) a full statement of the reasons on the basis of which it is claimed that a public disclosure of the information would adversely affect the interests of the objecting person and is not required in the interest of the public, or that the information is of a secret nature affecting the national defense.

(3) Such motion shall be filed with the examiner or the person conducting the hearing or proceeding, as the case may be, or with the person with whom said application, report, or document is required to be filed.

If such motion relates to contracts, agreements, understandings, or arrangements filed pursuant to section 412 (a) of the Civil Aeronautics Act of 1938, as amended, and Part 261 of this chapter, or pursuant to Part 262 of this chapter, an executed original copy and two copies of such motion shall be filed.

(e) *Motions referred to the Board.* The order of the Board containing its ruling upon each such motion will specify the extent to which, and the conditions upon which, the information may be disclosed to the parties and to the public, which order shall become effective upon the date stated therein, unless, within five days after the date of the entry of the Board's order with respect thereto, a petition is filed by the objecting person requesting reconsideration by the Board, or a written and verified statement is filed indicating that the objecting person in good faith intends to seek judicial review of the Board's order.

(f) *Objections in proceeding before the Board.* Notwithstanding any of the provisions of this section, whenever the objection to disclosure of information shall have been made, in the first instance, before the Board itself, the written motion of objection contemplated by paragraphs (a), (b), and (d) of this section shall not be necessary, but may be submitted if the parties so desire or if the Board, in a particular case, shall so direct.

§ 302.17 *Representation of private parties by persons formerly associated with the Board.* (a) No person who has been associated with the Civil Aeronautics Board as a member, officer, or employee thereof shall be permitted, within six months from the date of the termination of such association, to appear before the Board in behalf of, or to represent in any manner, any private party in connection with any proceeding which was pending before the Board at the time of his association with the Board.

(b) This section shall not apply to any member, officer, or employee who has terminated his association with the Board, prior to January 27, 1941.

[Amdt. 1, 6 F. R. 784, as redesignated at 14 F. R. 3522]