Civil Aeronautics Manual 35

Flight Engineer Certificates

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U. S. DEPARTMENT OF COMMERCE

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CIVIL AERONAUTICS ADMINISTRATION

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Introductory Note

Civil Aeronautics Manual 35 contains in a consolidated form (1) Civil Air Regulations, Part 35, Flight Engineer Certificates, adopted by the Civil Aeronautics Board and amendment 35–1; and (2) the rules, policies, and interpretations issued by the Administrator of Civil Aeronautics in application to the various sections of the regulations.

CAA *rules* are supplementary regulations issued pursuant to authority expressly conferred on the Administrator in the Civil Air Regulations. Such rules are mandatory and must be complied with.

CAA *policies* provide detailed technical information on recommended methods of complying with the Civil Air Regulations. Such policies are for the guidance of the public and are not mandatory in nature.

CAA *interpretations* define or explain words and phrases of the Civil Air Regulations. Such interpretations are for the guidance of the public and will be followed by the Administration in determining compliance with the regulations.

This manual is arranged to give the number, title, and text of each section of the regulations followed by any rules, policies, or interpretations applicable to that section. These rules, policies, or interpretations of the Administrator are identified by consecutive dash numbers appended to the regulation section number.

This manual contains all material published as Supplement No. 2, dated January 2, 1951, and Supplement No. 3, dated July 2, 1951, to Civil Aeronautics Manual 35. It will be revised from time to time in accordance with the changes in the Civil Air Regulations Part 35, or as the need for additional explanations are brought to the attention of the Administrator.

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Flight Engineer Certificates

35.1 *Issuance.* A flight engineer certificate will be issued to an applicant who meets the requirements of sections 35.2–35.9.

35.2 *Age.* Applicant shall be at least 21 years of age.

35.3 *Citizenship.* An applicant for a flight engineer certificate may be a citizen of any country or a person without nationality.

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 as prescribed in Part 29 of this subchapter: *Provided* That an applicant who is unable to distinguish aviation signal red, aviation signal green, and white shall be issued an airman certificate appropriately endorsed to prohibit the holder thereof from exercising the privileges of such certificate except under such conditions, or with the use of such equipment, which would not require the ability to distinguish such aviation signal colors.

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 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 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 section 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.

35.6–1 *Requirements for approved flight engineer courses. (CAA rules which apply to sec. 35.6 (d).)*

(a) *General.*

(1) Section 35.6 provides that an applicant for a flight engineer certificate shall have met certain specified experience requirements or be a graduate of a flight engineer course approved by the Administrator.

(2) Graduates of a flight engineer course approved by the Administrator are deemed to have met the experience requirements for the certificate. This means that they are accepted on equal terms with an applicant who has met the minimum experience requirements. For these reasons, it is essential that the requirements for approved flight engineer courses include adequate training facilities and sufficient coverage of the subject to insure acceptable proficiency of flight engineers who apply for certification as graduates of an approved course.

(b) *Training course outline and application for approval.*

(1) *Application for approval.* The agency or applicant desiring approval of a flight engineer course must submit to the local CAA Aviation Safety District Office three copies of the course outline, a description of the facilities and equipment to be used, and a list of instructors with their qualifications, together with a letter to the Administrator requesting approval.

(2) *Training course outline.*

(i) It is not mandatory that the training course outline have the subject headings arranged exactly as listed in the following example. Any arrangement of general headings and subheadings will be satisfactory provided all the subject material listed here is included. Each general subject of the outline shall be

broken down in detail showing items to be covered.

(ii) A complete and separate course outline is required for each type of aircraft (Lockhead Constellation, Douglas DC-4, Douglas DC-6, Boeing 307, Boeing 377, etc.) for which approval of flight engineer training is requested.

(iii) Additional subjects, such as international law, flight hygiene, radio repair, flight radio operation, flight navigation, or others not closely associated with flight engineering, may not be included in hourly requirements of the approved training outline. If an operator desires to add such subjects to a training course outline, they shall be separated from the required flight engineer subjects, and the time devoted thereto shall not be applied toward meeting the established time minimums.

(3) *Format of training outline.* The ground course outline and the flight course outline shall be combined in one loose-leaf binder and shall include a table of contents divided into two parts, ground course and flight course. Each part of the table of contents must contain a list of the major subjects, together with hours allotted to each subject and the total classroom and flight hours.

(4) *Ground course outline.* The following subjects and classroom hours are considered the minimum coverage for the ground training portion of the flight engineer course:

Subject	*Classroom hours*
Theory of Flight and Aerodynamics	10
Basic Maintenance of Aircraft	20
Aircraft structures.	
Aircraft systems.	
Aircraft powerplants.	
Servicing methods and precautions.	
Aircraft Familiarization	90
Specifications.	
Construction features.	
Flight controls.	
Hydraulic system.	
Electrical system.	
Anti-icing and de-icing systems.	
Heating, ventilating, and supercharging.	
Vacuum system.	
Pitot static system.	
Instrumentation.	
Fuel system.	
Emergency equipment.	
Aircraft maintenance.	
Engine Familiarization	45
Specifications.	
Construction features.	
Lubrication.	
Ignition.	
Carburetion and induction.	
Accessories.	
Propellers.	
Instrumentation.	
Emergency equipment.	
Engine maintenance.	
Normal Operations (Ground and Flight)	50
Use and trouble shooting of all aircraft systems.	
Loading and c. g. computation.	
Use and trouble shooting of all engine systems.	
Cruise control.	
Power and fuel consumption computations.	
Meteorology applicable to engine operation.	
Emergency Operation	30
Use of portable fire extinguishers.	
Fuselage fire and smoke control.	
Engine fire control.	
Heating system fire control.	
Loss of engine power.	
Loss of hydraulic power.	
Loss of electrical power.	
Propeller feathering and unfeathering.	
Civil Air Regulations	5
Part 4.	
Part 18.	
Part 35.	
Part 41.	
Part 60.	
TOTAL REQUIRED CLASSROOM INSTRUCTION TIME	250

Theory of Flight and Aerodynamics, Basic Maintenance of Aircraft, and Civil Air Regu-

lations need not apply to any specific type of aircraft. The remaining major headings must apply to the same type aircraft in which the student receives the required minimum hours of flight training.

(5) *Flight course outline.* The following subjects and flight training hours are considered the minimum coverage for the flight training portion of the flight engineer course:

Subject

Normal Flight Duties and Operation:
- Power control.
- Power computation.
- Temperature control.
- Normal engine operation analysis.
- Fuel system management.
- Cabin pressure control.
- Operation of all systems.
- Long range operation.
- Fuel consumption computation.

Recognition of Malfunctioning and Trouble Shooting:
- Analysis of abnormal engine operation.
- Analysis of trouble in all systems.
- Temporary repairs.

Emergency Flight Duties and Operation:
- Engine fire control.
- Aircraft fire control.
- Smoke control.
- Loss of power in each system.
- Gear and flap, extension, and retraction.
- Propeller feathering and unfeathering.
- Runaway propellers.

The Minimum Flight Time Shall Be 25 Hours.

The flight training curriculum must provide for the minimum of 25 hours of flight instruction in a specified type of aircraft having four engines or more. If a student is to receive flight training in more than one type aircraft, the flight time in one can not be applied to the flight time in another for the purpose of obtaining the required minimum.

To obtain credit for flight instruction time, the student must occupy the seat provided for the regular flight engineer on the aircraft being flown and must operate the controls in a manner which will provide experience in the subjects listed in the flight course outline. Student observation of another crew member or another student performing such duties or operations is not considered adequate training.

Only one student may be credited with flight time during any one period of flight. If two or more students are carried on the same flight, each student shall be credited only with the flight time he has actually spent at the controls under the supervision of a qualified flight engineer.

A maximum of 12½ hours of the required flight training may be obtained in acceptable types of synthetic training devices. To be acceptable, the synthetic flight training device must closely resemble the flight engineer station of the airplane in which the flight training will be given. Such resemblance need not include external similarity between the trainer and the airplane; however, the flight engineer station, controls, and instrumentation should be installed in such a manner that the student will not require extensive familiarization upon entering the actual airplane.

Synthetic flight training devices must include the following instrumentation and equipment:

(i) All engine instruments and engine controls which are normally carried in the aircraft.

(ii) All instruments and controls required for operation of the aircraft systems, including electrical system, hydraulic system, vacuum system, and air pressure system (flight controls excepted).

(iii) An altimeter, and air-speed indicator, a rate of climb indicator, an outside air temperature gauge, and a clock.

(iv) Cabin supercharger controls and instruments identical to those used in the type of aircraft concerned.

The instruments must be coupled to the various controls in such a manner that all instruments will respond automatically and normally to adjustment of pertinent controls.

A method shall be provided to separately control each instrument in order to present indications of malfunctioning to the student.

(c) *Equipment.*

(1) Classroom equipment shall include wall charts for each general system of the aircraft and its power plants.

(2) Aircraft suitable for the flight training must be available to the approved course

operator to insure that the flight training may be completed without undue delay. The approved course operator may contract or obtain written agreements with aircraft operators for the use of suitable aircraft. A copy of the contract or written agreement with an aircraft operator shall be attached to each of the three copies of the course outline submitted for approval. In all cases, the approved course operator is responsible for the nature and quality of instructions given during flight.

(d) *Instructors.*

(1) Sufficient classroom instructors must be available to prevent an excessive ratio of students to instructors. Any ratio in excess of 25 to 1 will be considered unsatisfactory.

(2) At least one instructor who possesses a valid flight engineer certificate must be available for coordination of ground course instruction.

(3) Instructors who conduct flight training must possess valid flight engineer certificates.

(e) *Revision of training course.* Requests for revisions to course outline, facilities, and equipment shall follow procedures for original approval of the course. Revisions should be submitted in such form that an entire page or pages of the approved outline can be removed and replaced by the revisions.

The list of instructors may be revised at any time without request for approval, provided the minimum requirement of paragraph (d) of this section is maintained.

(f) *Credit for previous training and experience.*

(1) Credit may be granted by an operator to students for previous training and experience which is provable and comparable to portions of the approved curriculum. When granting such credit, the approved course operator should be fully cognizant of the fact that he is responsible for the proficiency of his graduates in accordance with paragraph (h) of this section.

(2) Where advanced credit is allowed, the operator shall evaluate the student's previous training and experience in accordance with the normal practices of accredited technical schools. Before credit is given for any ground school subject or portion thereof, the student must pass an appropriate examination given by the operator. The results of the examination, a summary of the experience or training used as a basis for credit allowance, and the hours credited shall be incorporated as a part of the student's records.

(g) *Student records and reports.* Approval of a course shall not be continued in effect unless the course operator keeps an accurate record of each student, including a chronological log of all instruction, attendance, subjects covered, credits granted, examinations and examination grades, and unless he prepares and transmits to the Civil Aeronautics Administration not later than January 31 of each year a report containing the following information:

(1) The names of all students graduated and date of graduation.

(2) The ground course grades of each student.

(3) The flight course grades of each student.

(4) The total ground course hours for each student.

(5) The total flight instruction time for each student.

(6) The names of all students failed or dropped, together with dates, school grades, and reasons for dropping.[1]

(h) *Quality of instruction.* The quality of instruction shall be such that at least eighty percent of the students who apply within ninety days after graduation will be able to qualify on the first attempt for certification as flight engineer.

(i) *Statement of graduation.* Each student who successfully completes the approved flight engineer course shall be given a statement of graduation. An acceptable statement of graduation is:

CIVIL AERONAUTICS ADMINISTRATION,
Washington 25, D. C.

GENTLEMEN: This is to certify that

(Name of graduate)

on ---
(Date of graduation)

successfully completed a course of training for flight engineers which is approved by the Administrator of Civil Aeronautics.

Signed ---
Title ---
School ---

[1] See appendix C for a sample of a flight engineer course annual report.

(j) *Cancellation of approval.*

(1) The failure to meet or maintain any of the requirements established herein for the approval and operation of an approved course of study shall be considered sufficient grounds for cancellation of the approval to operate an approved course of study.

(2) If an approved course operator should desire voluntary cancellation of the course of study, he should submit a letter to the Administrator of Civil Aeronautics through the local agent requesting cancellation and surrendering his letter of approval.

(k) *Change of ownership, name, or location.*

(1) *Change of ownership.* Approval of a flight engineer course shall not be continued in effect after the course has changed ownership. The new owner must obtain a new approval by following the procedure prescribed for original approval.

(2) *Change of name or location.* Approval of a flight engineer course shall not be continued in effect when there is a change in name or location of an approved course operation by the same owner, unless the change in name or location is reported immediately by the owner to the local Aviation Safety office and the standards established in this manual are maintained, in which case a letter of approval showing the new name or location will be issued to the operator.

(l) *Duration.* The authority to operate an approved flight engineer training course shall expire 24 months after the last day of the month of issuance: *Provided,* That any such authorization granted prior to December 1, 1949, shall expire on December 31, 1951.

(m) *Renewal.* Application for renewal of an approved flight engineer training course may be made by letter to the Administrator through the local Aviation Safety Agent at any time within 60 days prior to the expiration date. Renewal of approval will depend upon the course operator meeting the current conditions for approval and having a satisfactory record as an operator.

(Published in 16 F. R. 4306, May 10, 1951, effective May 11, 1951.)

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) Responsiblities 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.

35.7–1 *The content and scope of the written examination required for a flight engineer certificate in proof of aeronautical knowledge (CAA policies which apply to sec. 35.7.)*

The written examination is designed for the specific purpose of determining whether an applicant possesses the basic theoretical knowledge required for the safe performance of his duties as a flight engineer.

Since a flight engineer's aeronautical knowledge is extensive in scope, complete coverage in the examination is not feasible. The written examination offered is a sampling device wherein a limited number of questions are proposed for the purpose of determining knowledge.[2]

(Published in 16 F. R. 1630, Feb. 16, 1951, effective upon publication.)

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 appli-

[2] The Administrator has compiled a study guide to aid applicants in preparing for the flight engineer certificate written examination. This guide is contained in appendix A.

ances, and the taking of appropriate action thereon;

(c) Emergency duties and procedures relating to aircraft, aircraft engines, propellers, and appliances.

35.8–1 *The content and scope of the practical examination required for a flight engineer certificate in proof of aeronautical skill (CAA policies which apply to sec. 35.8.)*

The practical examination is designed for the specific purpose of determining whether an applicant possesses the necessary skill required for the safe performance of his duties as a flight engineer.[3]

(Published in 16 F. R. 1630, Feb. 16, 1951, effective upon publication.)

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 sections 35.1 through 35.6, and (3) the applicant passes written and practical examinations respecting such aircraft on the subjects listed in sections 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 sections 35.7 and 35.8.

35.9–1 *Limited flight engineer certificates under which flight engineers may serve aboard aircraft having less than four engines and incorporating a flight engineer station (CAA policies which apply to sec. 35.9).*

(a) *General.* The holder of a limited flight engineer certificate is restricted to the operation of aircraft types on which he has been examined. These types are listed on his certificate.

(b) *Eligibility for the examinations.*

(1) *Written.* An applicant for a limited flight engineer certificate must meet the requirements of the Civil Air Regulations regarding age, citizenship, education, and experience before he will be permitted to take the written examination.

(2) *Practical.* An applicant for a limited flight engineer certificate must meet the requirements of the Civil Air Regulations regarding age, citizenship, education, physical standards, and experience before he will be permitted to take the practical examination.

(c) *Written examination.* The applicant for a limited flight engineer certificate is required to satisfactorily complete Sections 1, 2, and 3 of the flight engineer written examination (as described in appendix A), and Section 4 on the type aircraft which he intends to operate. Section 4, as required in the limited certificate examination, is presently available for PBY–5A type aircraft only, and is similar in scope to the examinations provided for four-engine aircraft.

(d) *Practical examination.* The applicant is required to satisfactorily complete the practical examination on the same type aircraft on which he completed the written examination. The practical examination is similar in scope to that described in appendix B, with the following exceptions:

(1) The applicant must supply an aircraft (for the practical examination) having less than four engines and incorporating a flight engineer station satisfactory to the Administrator, and

(2) Any item not applicable to the operation of the specific aircraft may be eliminated from the examination.

Information concerning the items not applicable to a certain type aircraft may be obtained from the local Aviation Safety Agent.

(e) *Removal of limitations.* The holder of a limited certificate may have the limitations removed by satisfactorily completing Section 4 of the written examination and the practical examination on one of the aircraft types described in Civil Air Regulations 35.7 and 35.8. It will not be necessary to retake Sections 1, 2, and 3 of the written examination.

(Published in 16 F. R. 1630, Feb. 16, 1951, effective upon publication.)

Certification Rules

35.10 *Application.* Application shall be made on a form and in the manner prescribed by the Administrator.

[3] The Administrator has compiled a guide to aid applicants in preparing for the flight engineer certificate practical examination. This guide is contained in appendix B.

35.11 *Duration.*

(a) A flight engineer certificate issued to a United States citizen shall remain in effect until surrendered, suspended, revoked, or otherwise terminated by order of the Board. A certificate issued to an applicant other than a United States citizen shall remain in effect for a period no longer than 12 months after the date of issuance, but it may be reissued without further demonstration of technical competence.

(b) After revocation, and upon request after suspension, the certificate shall be returned to the Administrator.

(c) Nothing in this section shall be construed to deny or defeat the jurisdiction of the Federal courts, the Administrator, or the Board to impose any authorized sanction, including revocation of the certificate, for a violation of the act or of the regulations in this subchapter occurring during the effective period of the certificate.

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.

35.14 *Reexamination after failure.* An applicant who has failed any prescribed written or practical examination or test may not apply for reexamination within a 30-day period unless he presents a statement signed by a certificated flight engineer, a certificated ground instructor, or an equally qualified individual acceptable to the Administrator, which attests that the applicant has received an additional 5 hours of instruction in each of the subjects failed and that the applicant is considered competent for reexamination.

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.

35.16 *Medical certificate and renewal.* No individual shall exercise the privileges of a flight engineer certificate unless he had 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.

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.

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.

35.19 *Change of address.* Within 30 days after any change in the permanent mailing address of a holder of a flight engineer certificate, the holder shall notify the Administrator in writing of such change. Such notice shall be mailed to the Administrator of Civil Aeronautics, Attention Airman Records Branch, Washington 25, D. C.

35.20 *Identification.* The holder of a certificate issued under the provisions of this part shall not, except while engaged in operations conducted by a scheduled air carrier, exercise the privileges conferred by the certificate unless he has in his personal possession a current airman identification card or other identification card acceptable to the Administrator which duly describes him. The airman identification card may be obtained from the Administrator who shall prescribe its form and the manner of applying for it.

Definitions

35.30 *Definitions.* As used in this part the words listed shall be defined as indicated in sections 35.31 and 35.32.

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).

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.

Appendix A

Study Guide for the Written Examination Required for a Flight Engineer Certificate

(a) Taking the Examination.

The applicant should read each statement or question carefully so that the problem is fully and completely understood. An attempt should be made by the applicant to frame in his mind not only the problem, but also what he conceives to be a satisfactory answer. After this process is followed, the applicant should then determine which answer among those given, most exactly corresponds with the answer which he has arrived at from reading and understanding the problem involved.

The subject of the examination will always provide a clue to the answer; e. g., if the subject deals with Civil Air Regulations, a regulation is involved in the correct answer. From the possible answers given it may appear that there is more than one correct answer; however, there is only one answer that may be considered correct and complete in its entirety. The possible choices provided, other than the one correct answer, are incomplete, involve incorrect procedures, or result from popular misconception. Care should be exercised to ascertain that the answer chosen fully and completely answers the problem involved. There are no trick questions or answers.

If difficulty is encountered with a particular problem, the applicant should proceed to the next problem where the answer is known. When the known problems of a particular section of the examination have been answered, he should go back to the unanswered problems. By utilizing this procedure, the applicant's time and energy will be conserved to his maximum advantage in the examination.

The applicant who is adequately prepared will have ample time to complete the examination within the prescribed time limit. Failure to complete the examination within the allotted time may indicate the absence of alertness, resourcefulness, power of analysis, and sound judgment, which are considered desirable attributes of a flight engineer. If these facts are remembered and followed no difficulty should be experienced with the examination.

The written examination is divided into seven sections as follows:

Section	*Question*
1. Civil Air Regulations	20
2. Theory of Flight and Aerodynamics	20
3. Aircraft and Engine Performance	25
4. Computations	25
5. Meteorology	10
6. Weight and Balance	10
7. Basic Maintenance	25

The allotted time for this examination is six hours.

The flight engineer examination question sheets, the applicant's answer sheets, and any scratch papers used during the examination must be surrendered to the proctor before the applicant leaves the examination room. Examination answer sheets are mailed immediately to the Washington office of the Civil Aeronautics Administration. An applicant must receive a grade of at least 70 percent in each section to be successful in the examination. A complete record of grades and other matters pertaining to the applicant's activity as an airman is maintained in the Washington office of the Civil Aeronautics Administration.

(b) The Examination—Reference Material.[4]

The following publicatons are suggested as study material for applicants for the flight engineer certificates. The publications listed below which are marked "GPO" may be ordered from the Government Printing Office. Orders must be accompanied by money order or check made payable and addressed to the Superin-

[4] The list of reference material has been brought up-to-date as of June 1956.

tendent of Documents, Government Printing Office, Washington 25, D. C. Publications marked "CAA" may be obtained from the Office of Aviation Information, Civil Aeronautics Administration, Washington 25, D. C.

Study Material	*Where Obtained*	*Cost*
Civil Air Regulations:		
Part 4b—Airplane Airworthiness—Transport Categories.	GPO	$0.25
Part 18—Maintenance, Repair, and Alteration of Certificated Aircraft and of Aircraft Engines, Propellers, and Instruments.	GPO	.05
Part 35—Flight Engineer Certificates.	GPO	.05
Part 40—Scheduled Interstate Air Carrier Certification and Operation Rules.	GPO	.15
Part 41—Certification and Operation Rules for Scheduled Air Carrier Operations Outside the Continental Limits of the United States.	GPO	.10
Part 42—Irregular Air Carrier and Off-Route Rules.	GPO	.10
Part 60—Air Traffic Rules	GPO	.10
Miscellaneous publications:		
Flight Engineering, (NAVPERS 10395A)	GPO	$0.75
Pilot's Weather Handbook TM-104	GPO	1.50
Civil Aeronautics Manual 18	GPO	1.75
Aircraft Powerplant Handbook TM-107	GPO	1.50
Factory maintenance manuals, operations manuals, and sepcification booklets	[a]	
Aircraft Engineering for Pilots (A. F. Manual 51-42	GPO	3.50
Aircraft Performance Engineering for Reciprocating Engines (A. F. Manual 51-9)	GPO	2.75
CAA approved operations manual (carried in airplane)	[a]	
Aircraft specifications and engine specifications prepared by the CAA on the specific type aircraft or engine	CAA	[b]

[a] Aircraft Owner or Operator.
[b] No charge.

The reference material generally applies to the written examination as follows:

Written Examination	*Reference Material*
Section 1	CAR's 4b, 18, 35, 41, 42, and 60.
Section 2	Miscellaneous publications.
Section 3	Miscellaneous publications.
Section 4	Factory mainetnance manuals, CAA approved operations manuals, and Aircraft and Engine specifications.

(c) Sample Examination Questions.

Typical questions, similar to those used in official flight engineer examinations, appear in the following text. Answers will be found on the last page. It should be noted that these questions are only "samples" and do not include all types asked in examinations, or all topics tested. The ability to answer these questions, therefore, does not necessarily indicate that the applicant is adequately prepared to take the examination. However, the questions will acquaint an applicant with the general form in which questions are presented and will enable instructors to construct similar questions to cover the entire field. Applicants should realize that proper preparation for this examination requires a considerable expenditure of time and effort, as well as guidance from a competent instructor.

(1) *Section one—Civil Air Regulations.*

1. Takeoff limitations require that an airplane must be able to
    1. clear all obstructions by 100 feet with all engines operating.
    2. clear all obstructions by 50 feet if one engine becomes inoperative after reaching V_1 air speed.
    3. clear all obstructions by 50 feet with one or more engines inoperative.
    4. stop within the length of the runway if an engine becomes inoperative at the point of reaching V_2 air speed.
2. Proper loading of an aircraft is the responsibility of the
    1. first pilot.
    2. copilot.
    3. air carrier agency.
    4. flight engineer.
3. Upon satisfactory completion of the appropriate written, practical, and physical examinations, you will receive a temporary

flight engineer certificate which is good for a period of
1. 120 days only.
2. 90 days only.
3. 90 days or more.
4. 60 days only.

4. Any hazardous condition of equipment or unsafe type of operation which you notice should be reported at once to
1. superintendent of maintenance.
2. chief flight engineer.
3. dispatcher.
4. operations manager.

5. A certificated flight engineer may make any necessary mechanical repairs
1. as a privilege of his flight engineer certificate.
2. provided the work is inspected by an Aviation Safety Agent after the aircraft has returned to its home base.
3. when he also holds a mechanic certificate.
4. if he has graduated from an approved flight engineer school.

6. You are the flight engineer aboard an airplane carrying the following occupants: Mr. Jones, who is the registered owner of the airplane; Mr. Brown, an Aviation Safety Agent; and Mr. Smith, the pilot. During flight an engine becomes inoperative and the propeller is feathered. A difference of opinion then arises concerning the procedure to be followed during remainder of the flight. Final decision rests with
1. Mr. Jones.
2. Mr. Smith.
3. Mr. Brown.
4. you.

7. The fuel supply for short distance contact operation must be adequate to reach the next point of landing and thereafter fly for a period of at least
1. 1 hour, 30 minutes.
2. 30 minutes.
3. 1 hour, 45 minutes.
4. 45 minutes.

(2) *Section two—Theory of Flight and Aerodynamics.*

1. An aircraft in flight is developing or utilizing various forces. Which of the following combinations of forces will provide the aircraft with forward motion?
1. Centrifugal force greater than lift.
2. Centripetal force greater than torsion.
3. Thrust greater than drag.
4. Lift greater than weight.

2. An aircraft in flight will produce thrust, drag, lift, centrifugal force, torsion, and centripetal force. Which of the following supplies centrifugal force in a turn during flight?
1. Torsion of the engine.
2. Lift of the wings.
3. Thrust of the engine and propeller.
4. Weight of the aircraft.

(3) *Section three—Aircraft and Engine Performance.*

1. In which of the following conditions will an airplane be able to travel the greatest distance and still return to the point of departure?
1. No wind while flying outbound and while flying inbound.
2. Tail wind while flying outbound and head wind while flying inbound.
3. Head wind while flying outbound and tail wind while flying inbound.
4. Direct cross wind while flying outbound and while flying inbound.

2. During flight with a constant and unchanging power applied to a constant speed propeller, the blades will
1. increase pitch during climb.
2. increase pitch during descent.
3 decrease pitch with an increase of air speed during level flight
4. decrease pitch during climb.

3. Which of the following conditions is representative of an airplane engine being operated at critical altitude?
1. Full r. p. m. and ¼ of the maximum throttle.

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2. Full throttle at any r. p. m.
3. ¾ of the maximum r. p. m. and ¾ of the maximum throttle.
4. ½ of the maximum r. p. m. and ½ of the maximum throttle.

4. An increase in carburetor air temperature while operating at the same altitude with the same r. p. m. and MAP will produce
   1. more horsepower.
   2. the same horsepower.
   3. a fluctuating horsepower.
   4. less horsepower.

(4) *Section four—Computations.*

1. How much fuel will be consumed by each engine of a four-engine airplane during a flight of 3 hours, 37 minutes. when the engines are developing 1,000 horsepower each and operating on a specific fuel conconsumption of 0.50?
   1. 301 gallons.
   2. 250 gallons.
   3. 83 gallons.
   4. 375 gallons.

   (NOTE: Compute fuel weight at 6 pounds per gallon.)

2. An engine of 2,400 cubic inches displacement developing 125 BMEP. (Brake Mean Effective Pressure) with fuel flow of 350 pounds per hour at 2,000 r. p. m. would be operating at a specific fuel consumption of
   1. 0.490.
   2. .470.
   3. .455.
   4. .462.

3. What is the tip speed of a propeller 10 feet in diameter turning 2,400 r. p. m.?
   1. 31.41 feet per second.
   2. 896.72 feet per second.
   3. 1,256.64 feet per second.
   4. 1,464.96 feet per second.

4. One 24-volt generator of 300 ampere capacity is turned on to supply the following loads
   a. Radio receiver—2,400 watts.
   b. Radio transmitter—3,600 watts.
   c. Lights—960 watts.
   d. All instruments—10 amperes.

   If all loads are turned "ON," the rated output of the generator will be exceeded by
   1. zero amperes.
   2. 10 amperes.
   3. 20 amperes.
   4. 25 amperes.

5. What is the wing loading of an aircraft weighing 80,000 pounds and containing 1500 square feet of wing area?
   1. 48.96 pounds per square foot.
   2. 53.33 pounds per square foot.
   3. 56.72 pounds per square foot.
   4. 62.87 pounds per square foot.

6. What is the takeoff power loading of an aircraft weighing 96,000 pounds and containing four engines developing 2,400 horsepower each at takeoff?
   1. 10 pounds per horsepower.
   2. 15 pounds per horsepower.
   3. 25 pounds per horsepower.
   4. 40 pounds per horsepower.

7. What is the Brake Mean Effective Pressure in pounds per square inch, when an engine with a piston displacement of 3,000 cubic inches is developing 1,200 horsepower at 2,400 r. p. m.?
   1. 140 BMEP.
   2. 135 BMEP.
   3. 128 BMEP.
   4. 132 BMEP.

8. What is the "K" value (used in the horsepower formula) for an engine with a total piston displacement of 3,600 cubic inches?
   1. 186.
   2. 220.
   3. 234.
   4. 260.

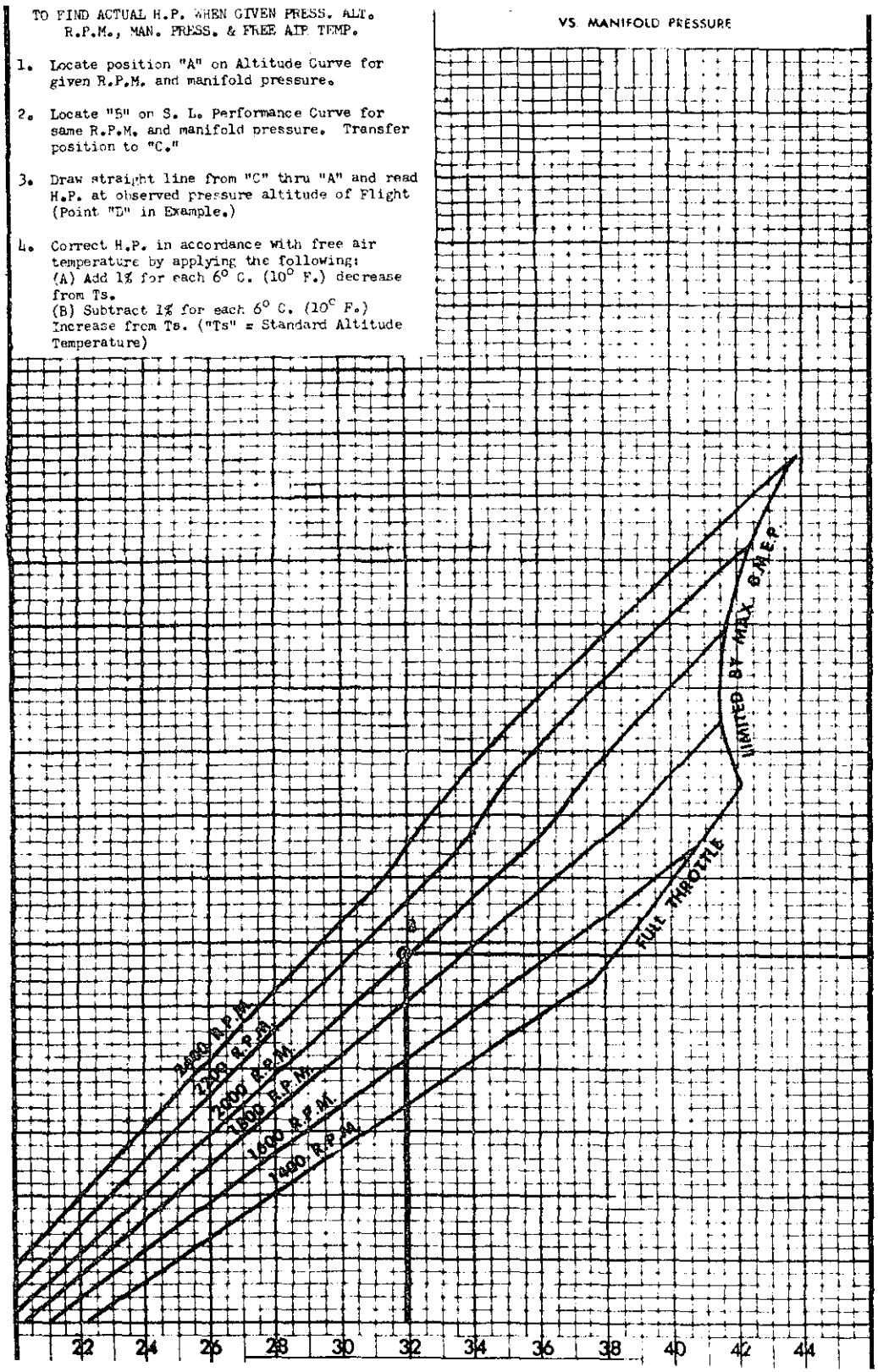
9. What manifold pressure (MAP) would be required to obtain 1,270 horsepower while operating with 2,400 r. p. m., 11,000 feet altitude, and with standard outside air temperature?
   1. 37 inches Hg.
   2. 37.4 inches Hg.
   3. 36.5 inches Hg.
   4. 34 inches Hg.

   NOTE: Refer to the Sample Power Chart.

TO FIND ACTUAL H.P. WHEN GIVEN PRESS. ALT. R.P.M., MAN. PRESS. & FREE AIR TEMP.

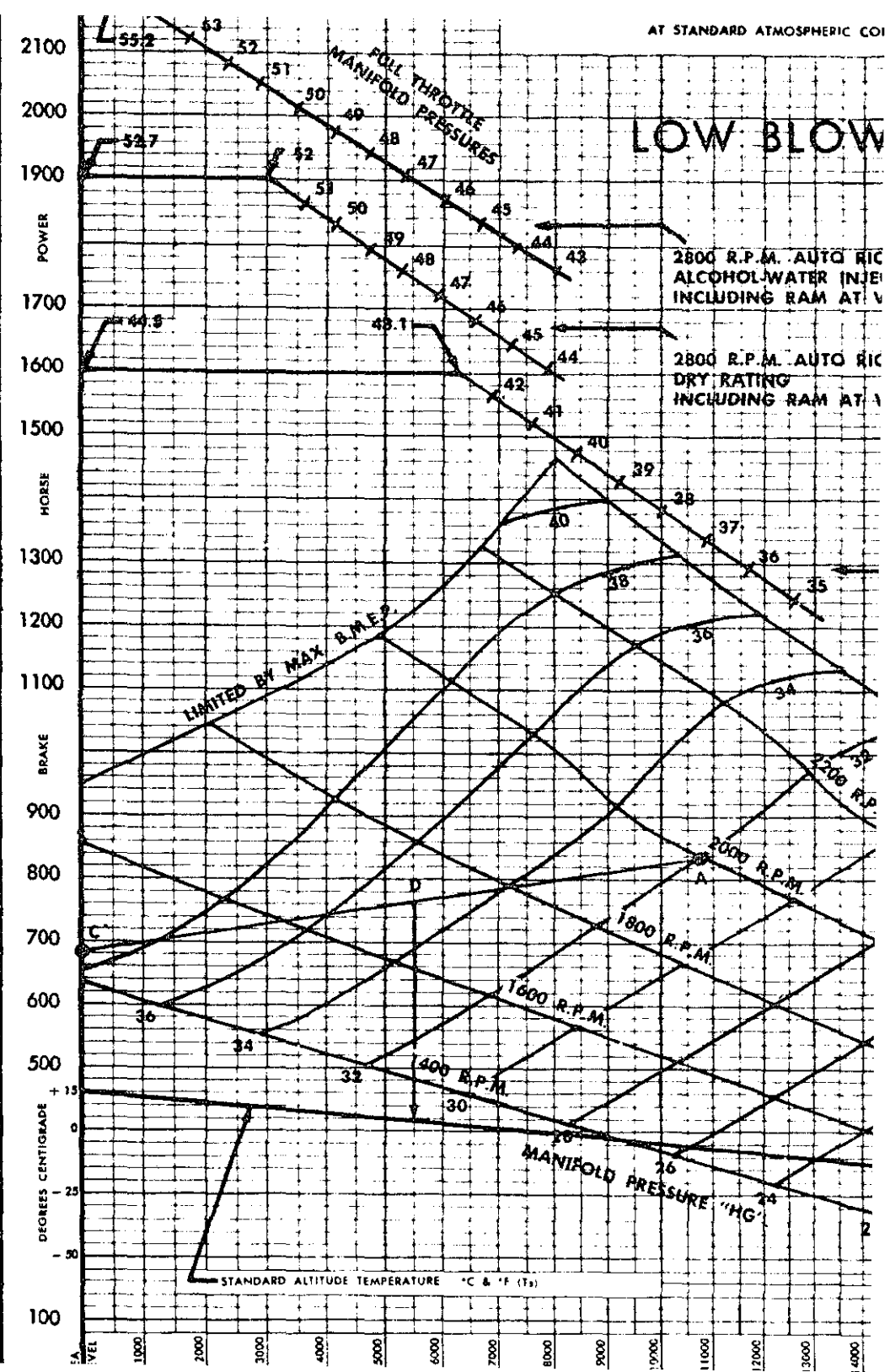
1. Locate position "A" on Altitude Curve for given R.P.M. and manifold pressure.
2. Locate "B" on S. L. Performance Curve for same R.P.M. and manifold pressure. Transfer position to "C."
3. Draw straight line from "C" thru "A" and read H.P. at observed pressure altitude of Flight (Point "D" in Example.)
4. Correct H.P. in accordance with free air temperature by applying the following:
   (A) Add 1% for each 6° C. (10° F.) decrease from Ts.
   (B) Subtract 1% for each 6° C. (10° F.) Increase from Ts. ("Ts" = Standard Altitude Temperature)

VS. MANIFOLD PRESSURE



AT STANDARD ATMOSPHERIC CO

LOW BLOW



10. What horsepower will be obtained while operating at 9,500 feet altitude, 2,200 r. p. m., 36 inches MAP, and standard outside air temperature?
    1. 1,170 horsepower.
    2. 1,220 horsepower.
    3. 1,030 horsepower.
    4. 1,080 horsepower.

    NOTE: Refer to the Sample Power Chart.

11. What horsepower will be obtained while operating at 7,000 feet altitude, 2,200 r. p. m., 36 inches MAP, and standard outside air temperature?
    1. 1,170 horsepower.
    2. 1,025 horsepower.
    3. 1,250 horsepower.
    4. 1,130 horsepower.

    NOTE: Refer to the Sample Power Chart.

12. If the chart indicates that you are obtaining 1,000 horsepower at 5,000 feet altitude and the outside air temperature is −7 degrees Centigrade, what is the actual horsepower?
    1. 1,010 horsepower.
    2. 1,020 horsepower.
    3. 990 horsepower.
    4. 980 horsepower.

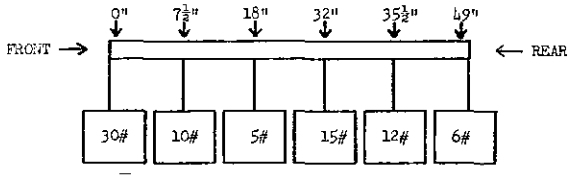
    NOTE: Refer to the Sample Power Chart.

(5) *Section five—Basic Meteorology.*

This section of the examination is composed of multiple choice questions dealing with basic meteorology as it affects the operation of aircraft and engines.

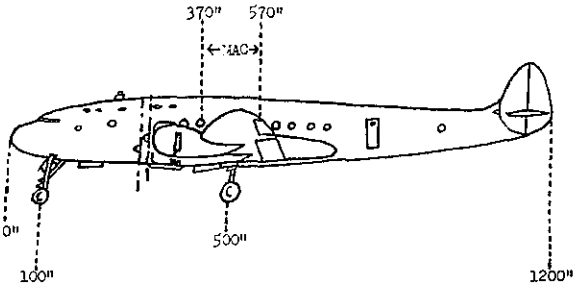
(6) *Section six— Weight and Balance.*

1. Assume the pictured bar to have no weight other than that attached to it.



Where is the center of gravity (c. g.) in relation to the front of the bar?
    1. 22.40 inches aft.
    2. 16.75 inches aft.
    3. 17.50 inches aft.
    4. 21.39 inches aft.

2.



The above aircraft was placed on scales and the following weights determined:
    Nose wheel—10,000 pounds
    Right main wheel—20,000 pounds
    Left main wheel—20,000 pounds

Where is the c. g. located in relation to the nose of the airplane?
    1. 390 inches aft.
    2. 420 inches aft.
    3. 445 inches aft.
    4. 432 inches aft.

3. Using the illustration and figures supplied in problem No. 2, compute the new c. g. location after making the following changes:
    a. Remove galley equipment weighing 800 pounds and located at station 800.
    b. Reinstall the same galley equipment at station 300.

    The new c. g. position will be
    1. 412 inches aft of nose.
    2. 420 inches aft of nose.
    3. 400 inches aft of nose.
    4. 426 inches aft of nose.

4. Using the illustration and figures supplied in problem No. 2, compute the c. g. location in percent of mean aerodynamic chord (MAC).
    1. 21 percent.
    2. 42 percent.
    3. 30 percent.
    4. 25 percent.

(7) *Section seven—Basic Maintenance.*

1. The use (during takeoff or other high power operations) of fuel grades or octane ratings

lower than those recommended for an engine will immediately cause
1. detonation.
2. slow combustion.
3. valve overlap.
4. piston ring blowby.

2. The output voltage and current of two or more generators should be balanced because
1. too much horsepower will be taken from the engine driving the higher output generator.
2. the compass will be adversely affected when the electrical loads are different in various parts of the airplane.
3. the higher output generator and its leads may overheat and cause fire.
4. a reverse flow of electrical current will be forced through the lower output generator and reverse its polarity.

(d) **Answers to Sample Questions.**

(1) *Civil Air Regulations.*

Question	*Answer*
1	2
2	3
3	2
4	4
5	3
6	2
7	4

(2) *Theory of Flight and Aerodynamics.*

Question	*Answer*
1	3
2	4

(3) *Aircraft and Engine Performance.*

Question	*Answer*
1	1
2	4
3	2
4	4

(4) *Computations.*

Question	*Answer*
1	1
2	4

(4) *Computations*—Continued

Question	*Answer*
3	3
4	1
5	2
6	1
7	4
8	2
9	1
10	1
11	4
12	2

(5) *Basic Meteorology.*

None.

(6) *Weight and Balance.*

Question	*Answer*
1	3
2	2
3	1
4	4

(7) *Basic Maintenance.*

Question	*Answer*
1	1
2	3

(e) **Reproduction and Dissemination of Current Examination Materials.**

Part 635, Regulations of the Administrator, prohibits the reproduction and dissemination of current examination materials. This regulations state that:

". . . No person shall use, reproduce, publish, or disseminate in whole or in part, without the consent of the Administrator:

"(a) Any examination questions in use by the Administration for the examination of applicants for airman or ground instructor certificates, or

"(b) Any material which purports to be a key sheet of specific answers to any multiple-choice examination paper in use by the Administration for the examination of applicants for airman or ground instructor certificates."

Appendix B

Study Guide for the Practical Examination Required for a Flight Engineer Certificate

(a) Examination Procedure.

The applicant for certification as flight engineer must supply the following equipment for use during the practical examination:

(1) An aircraft having four or more engines and certificated in the transport category or an aircraft having four or more engines and incorporating a flight engineer station;
(2) Suitable tools for removing and installing cowling and inspection access plates on the above aircraft;
(3) A slide rule or computer; and
(4) Factory or CAA approved operations manual for the above aircraft.

In addition, the applicant must have permission to

(1) remove part of the cowling and inspection access plates from the aircraft for the purpose of demonstrating troubleshooting and familiarity with the aircraft being used, and
(2) feather and unfeather at least one engine during flight.

The applicant must attain a grade of 70 percent or higher in each item of the practical examination in order to obtain a satisfactory final grade. Grades ranging from 0 to 69 percent are considered failing, while grades of 70 to 100 percent are considered satisfactory. A reexamination is required on all items containing failing grades.

(b) The Examination.

The practical examination is divided into two sections, ORAL and FLIGHT, containing 15 items in the ORAL section and 37 items in the FLIGHT section; a total of 52 items. These items as enumerated on the practical examination check sheet are identical in subject and number to the numbered items in the following explanations.

During the ORAL examination, the applicant is checked on his familiarity with the equipment, and his knowledge of location, operation, and troubleshooting of each of the following items:

1. Power Plant
2. Lubrication System
3. Carburetion and Fuel Systems
4. Electrical and Ignition Systems
5. Propellers
6. Instruments
7. Hydraulic System
8. Control System
9. Anti-icing and De-icing Systems
10. Heating and Ventilating System
11. Cabin Pressurizing System (if applicable)
12. Fire Extinguishing System
13. Oxygen System
14. Flight Engineer Station Familiarization
15. Normal Range of Instrument Readings

During the FLIGHT examination, the applicant is required to demonstrate his ability to satisfactorily perform the following normal operation duties:

16. Completion of Company Approved Loading Form
17. Preflight Check of Aircraft
18. Preflight Check of Engines and Propellers
19. Preflight Service Check of Fuel, Oil, Etc.
20. Preflight Check of Flight Engineer Station
21. Engine Starting
22. Engine Runup

23. Power Control During Takeoff
24. Power Control During Climb
25. Engine Temperature Control During Climb
26. Power Control During Cruise
27. Engine Temperature Control During Cruise
28. Power Control Computations
29. Engine Synchronization
30. Engine Operation Analysis
31. Fuel System Management
32. Heating and Ventilation Control
33. Cabin Pressure Control (if applicable)
34. Electrical System Operation
35. Power Control During Descent
36. Engine Temperature Control During Descent
37. Aircraft and Engine Logbook Entry
38. Computation of Fuel Consumption

The applicant is also required to demonstrate his ability to recognize the emergencies which may occur at any time during takeoff or flight. The emergencies considered in this examination are:

39. Engine Fire Control and Subsequent Procedure
40. Heater Fire Control
41. Cargo Compartment Fire
42. Cabin or Flight Station Fire
43. Cabin and Flight Station Smoke Control
44. Loss of Engine Oil Pressure
45. Loss of Hydraulic Power
46. Loss of Electrical Power
47. Emergency Gear Extension
48. Emergency Wing Flap Extension
49. Propeller Feathering and Unfeathering
50. Runaway Propellers
51. Fuel Dumping
52. Meto Power Application (missed approach)

All of the above emergency items are accomplished during flight as required in Section 35.8 (c) of the Civil Air Regulations. It is impossible to safely actualize an engine fire, a cargo compartment fire, a broken oil line, a runaway propeller, short circuited electrical equipment, and various other emergencies; therefore, such items, except number 49 and number 52, of the emergency operation portion of the flight examination may be simulated. An actual feathering and unfeathering (item number 49) of at least one propeller will be accomplished during the flight examination.

The simulation of emergency items means that the CAA representative will tell the applicant (during flight) that a certain condition (engine fire, broken oil line, cargo compartment fire, etc.) exists in a certain part of the airplane. The applicant is then required to tell the examiner what should be done to correct or lessen the danger of the situation, and at the same time place his hand, in proper sequence, on each control, valve, or switch and explain in what position the control will be placed. When actual or simulated emergency conditions are presented to the applicant, his reactions and answers must be correct and reasonably prompt. Propeller feathering, item number 49, is usually accomplished during engine fire or engine malfunctioning checks.

In summary:

Items number 1 through number 22 will be checked on the ground.

Items number 16 through number 22 are preflight duties and should be accomplished immediately prior to takeoff on the flight check.

Items number 23 through number 52 will be checked during flight.

Items number 39 through number 48 and number 50 through number 51 may be simulated during flight.

Items number 49 and 52 must be accomplished during flight.

Items number 1 through number 38, item number 49, and item number 52 will not be simulated.

Blank spaces for additional items are provided on the practical examination check sheet for use by the CAA representative. These spaces may be used for any special equipment installed in the applicant's aircraft, special type operations required of the applicant by his employer, or any other items the examiner or agent may consider necessary.

Appendix C

Sample Report Form

FLIGHT ENGINEER COURSE

ANNUAL REPORT

(SAMPLE)

Name of School	Location	Date of Report

Student	Date of Graduation or Failure	Average Final Grades		Total Instruction Time		Remarks (Examination grades on subjects where advance credit was given) or (reasons for dropping student)
		Ground	Flight	Ground	Flight	

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Dec. 31, 56

Introductory Note

Civil Aeronautics Manual 35 contains in a consolidated form (1) Civil Air Regulations, Part 35, Flight Engineer Certificates, adopted by the Civil Aeronautics Board and amendment [35-3;] and (2) the rules, policies, and interpretations issued by the Administrator of Civil Aeronautics in application to the various sections of the regulations.

CAA *rules* are supplementary regulations issued pursuant to authority expressly conferred on the Administrator in the Civil Air Regulations. Such rules are mandatory and must be complied with.

CAA *policies* provide detailed technical information on recommended methods of complying with the Civil Air Regulations. Such policies are for the guidance of the public and are not mandatory in nature.

CAA *interpretations* define or explain words and phrases of the Civil Air Regulations. Such interpretations are for the guidance of the public and will be followed by the Administration in determining compliance with the regulations.

This manual is arranged to give the number, title, and text of each section of the regulations followed by any rules, policies, or interpretations applicable to that section. These rules, policies, or interpretations of the Administrator are identified by consecutive dash numbers appended to the regulation section number.

This manual contains all material published as Supplement No. 2, dated January 2, 1951, and Supplement No. 3, dated July 2, 1951, to Civil Aeronautics Manual 35. It will be revised from time to time in accordance with the changes in the Civil Air Regulations Part 35, or as the need for additional explanations are brought to the attention of the Administrator.

(Rev. 12/31/56)

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Flight Engineer Certificates

35.1 *Issuance.* A flight engineer certificate will be issued to an applicant who meets the requirements of sections 35.2–35.9.

35.2 *Age.* 21 years [is the minimum age for the issuance of a flight engineer certificate.]

35.3 *Citizenship.* An applicant for a flight engineer certificate may be a citizen of any country or a person without nationality.

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 as prescribed in Part 29 of this subchapter: *Provided* That an applicant who is unable to distinguish aviation signal red, aviation signal green, and white shall be issued an airman certificate appropriately endorsed to prohibit the holder thereof from exercising the privileges of such certificate except under such conditions, or with the use of such equipment, which would not require the ability to distinguish such aviation signal colors.

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 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 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 section 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.

35.6–1 *Requirements for approved flight engineer course (CAA rules which apply to sec. 35.6 (d)).*

(a) *General.*

(1) Section 35.6 provides that an applicant for a flight engineer certificate shall have met certain specified experience requirements or be a graduate of a flight engineer course approved by the Administrator.

(2) Graduates of a flight engineer course approved by the Administrator are deemed to have met the experience requirements for the certificate. This means that they are accepted on equal terms with an applicant who has met the minimum experience requirements. For these reasons, it is essential that the requirements for approved flight engineer courses include adequate training facilities and sufficient coverage of the subject to insure acceptable proficiency of flight engineers who apply for certification as graduates of an approved course.

(b) *Training course outline and application for approval.*

(1) *Application for approval.* The agency or applicant desiring approval of a flight engineer course must submit to the local CAA Aviation Safety District Office three copies of the course outline, a description of the facilities and equipment to be used, and a list of instructors with their qualifications, together with a letter to the Administrator requesting approval.

(2) *Training course outline.*

(i) It is not mandatory that the training course outline have the subject headings arranged exactly as listed in the following example. Any arrangement of general headings and subheadings will be satisfactory provided all the subject material listed here is included. Each general subject of the outline shall be

broken down in detail showing items to be covered.

(ii) A complete and separate course outline is required for each type of aircraft (Lockhead Constellation, Douglas DC–4, Douglas DC–6, Boeing 307, Boeing 377, etc.) for which approval of flight engineer training is requested.

(iii) Additional subjects, such as international law, flight hygiene, radio repair, flight radio operation, flight navigation, or others not closely associated with flight engineering, may not be included in hourly requirements of the approved training outline. If an operator desires to add such subjects to a training course outline, they shall be separated from the required flight engineer subjects, and the time devoted thereto shall not be applied toward meeting the established time minimums.

(3) *Format of training outline.* The ground course outline and the flight course outline shall be combined in one loose-leaf binder and shall include a table of contents divided into two parts, ground course and flight course. Each part of the table of contents must contain a list of the major subjects, together with hours allotted to each subject and the total classroom and flight hours.

(4) *Ground course outline.* The following subjects and classroom hours are considered the minimum coverage for the ground training portion of the flight engineer course:

Subject	*Classroom hours*
Theory of Flight and Aerodynamics	10
Basic Maintenance of Aircraft	20
Aircraft structures.	
Aircraft systems.	
Aircraft powerplants.	
Servicing methods and precautions.	
Aircraft Familiarization	90
Specifications.	
Construction features.	
Flight controls.	
Hydraulic system.	
Electrical system.	
Anti-icing and de-icing systems.	
Heating, ventilating, and supercharging.	
Vacuum system.	
Pitot static system.	
Instrumentation.	
Fuel system.	
Emergency equipment.	
Aircraft maintenance.	
Engine Familiarization	45
Specifications.	
Construction features.	
Lubrication.	
Ignition.	
Carburetion and induction.	
Accessories.	
Propellers.	
Instrumentation.	
Emergency equipment.	
Engine maintenance.	
Normal Operations (Ground and Flight)	50
Use and trouble shooting of all aircraft systems.	
Loading and c. g. computation.	
Use and trouble shooting of all engine systems.	
Cruise control.	
Power and fuel consumption computations.	
Meteorology applicable to engine operation.	
Emergency Operation	30
Use of portable fire extinguishers.	
Fuselage fire and smoke control.	
Engine fire control.	
Heating system fire control.	
Loss of engine power.	
Loss of hydraulic power.	
Loss of electrical power.	
Propeller feathering and unfeathering.	
Civil Air Regulations	5
Part 4.	
Part 18.	
Part 35.	
Part 41.	
Part 60.	
TOTAL REQUIRED CLASSROOM INSTRUCTION TIME	250

Theory of Flight and Aerodynamics, Basic Maintenance of Aircraft, and Civil Air Regu-

35.11 *Duration.*

(a) A flight engineer certificate issued to a United States citizen shall remain in effect until surrendered, suspended, revoked, or otherwise terminated by order of the Board. A certificate issued to an applicant other than a United States citizen shall remain in effect for a period no longer than 12 months after the date of issuance, but it may be reissued without further demonstration of technical competence.

(b) After revocation, and upon request after suspension, the certificate shall be returned to the Administrator.

(c) Nothing in this section shall be construed to deny or defeat the jurisdiction of the Federal courts, the Administrator, or the Board to impose any authorized sanction, including revocation of the certificate, for a violation of the act or of the regulations in this subchapter occurring during the effective period of the certificate.

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.

35.14 *Reexamination after failure.* An applicant who has failed any prescribed written or practical examination or test may not apply for reexamination within a 30-day period unless he presents a statement signed by a certificated flight engineer, a certificated ground instructor, or an equally qualified individual acceptable to the Administrator, which attests that the applicant has received an additional 5 hours of instruction in each of the subjects failed and that the applicant is considered competent for reexamination.

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.

35.16 *Medical certificate and renewal.* No individual shall exercise the privileges of a flight engineer certificate unless he had 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.

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.

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.

35.19 *Change of address.* Within 30 days after any change in the permanent mailing address of a holder of a flight engineer certificate, the holder shall notify the Administrator in writing of such change. Such notice shall be mailed to the Administrator of Civil Aeronautics, *Attention Airman Records Branch,* Washington 25, D. C.

Definitions

35.30 *Definitions.* As used in this part the words listed shall be defined as indicated in sections 35.31 and 35.32.

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).

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.

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~~Supplement 1 (Obsolete)~~

~~Supplement 2 - January 2, 1951~~

~~Supplement 3 - July 2, 1951~~

} superseded by CAM 35 dated ~~10/15/56~~ 4-30-57

~~CAM 35 includes study guide & list of suggested study material~~

New CAM 35 dated 4-30-57 does NOT include study guide or list of suggested study material.

Study Guide [illegible] [illegible], dated Dec 1956, & is [illegible] [illegible]