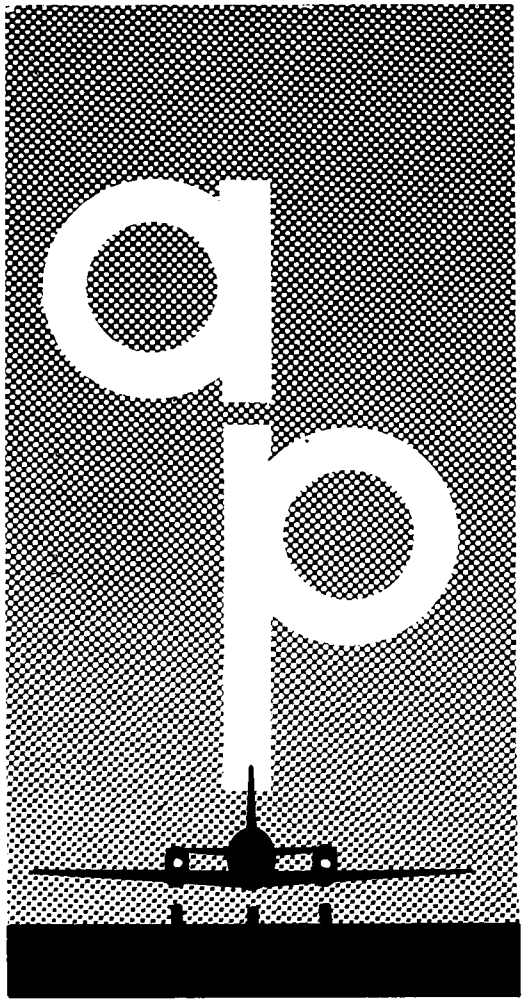


AC 65-2D

# Airframe & Powerplant MECHANICS

## Certification Guide

U.S. DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION

# AIRFRAME AND POWERPLANT MECHANICS CERTIFICATION GUIDE

**Revised**
**1976**

**U.S. DEPARTMENT OF TRANSPORTATION**
**FEDERAL AVIATION ADMINISTRATION**

# PREFACE

This guide was prepared by Flight Standards Service, Federal Aviation Administration, to provide information to prospective airframe and powerplant mechanics and other persons interested in the certification of mechanics. It contains information about the certificate requirements, application procedures, and the mechanic written, oral, and practical tests.

This guide supersedes AC 65–2C, Airframe and Powerplant Mechanics Certification Guide, dated 1973.

# CONTENTS


| | Page |
|---|---|
| PREFACE | iii |
| CONTENTS | v |
| INTRODUCTION | vii |
| ELIGIBILITY REQUIREMENTS FOR CERTIFICATION | 1 |
| Eligibility requirements: general | 1 |
| Knowledge requirements | 1 |
| Experience requirements | 1 |
| Skill requirements | 1 |
| Certificated aviation maintenance technician school students | 1 |
| THE WRITTEN TESTS | 3 |
| Written Test Report | 4 |
| Retesting after failure | 4 |
| AVIATION MECHANIC TEST CONTENTS | 5 |
| Aviation Mechanic General Test | 7 |
| Basic electricty | 7 |
| Aircraft drawings | 8 |
| Weight and balance | 8 |
| Fluid lines and fittings | 9 |
| Materials and processes | 9 |
| Ground operation and servicing | 10 |
| Cleaning and corrosion control | 11 |
| Mathematics | 11 |
| Maintenance forms and records | 12 |
| Basic physics | 12 |
| Maintenance publications | 13 |
| Mechanic privileges and limitations | 13 |
| AVIATION MECHANIC AIRFRAME TEST | 15 |
| Section 1. Airframe structures | 15 |
| Wood Structures | 15 |
| Aircraft covering | 15 |
| Aircraft finishes | 15 |
| Sheet metal structures | 16 |
| Welding | 17 |
| Assembly and rigging | 18 |
| Airframe inspection | 20 |
| Section 2. Airframe systems and components | 21 |
| Aircraft landing gear systems | 21 |
| Hydraulic and pneumatic power systems | 21 |
| Cabin atmosphere control systems | 23 |

## CONTENTS—Continued


| | Page |
|---|---|
| Aircraft instrument systems | 24 |
| Communication and navigation systems | 24 |
| Aircraft fuel systems | 24 |
| Aircraft electrical systems | 25 |
| Position and warning systems | 27 |
| Ice and rain control systems | 27 |
| Fire protection systems | 27 |
| AVIATION MECHANIC POWERPLANT TEST | 29 |
| Section 1. Powerplant theory and maintenance | 29 |
| Reciprocating engines | 29 |
| Turbine engines | 31 |
| Engine inspection | 31 |
| Section 2. Powerplant systems and components | 33 |
| Engine instrument systems | 33 |
| Engine fire protection systems | 33 |
| Engine electrical systems | 33 |
| Lubrication systems | 35 |
| Ignition systems | 36 |
| Fuel metering systems | 37 |
| Engine fuel systems | 39 |
| Induction systems | 39 |
| Engine cooling systems | 40 |
| Engine exhaust systems | 40 |
| Propellers | 40 |
| ORAL AND PRACTICAL TESTS | 43 |
| The oral test | 43 |
| Sample oral test questions | 43 |
| The practical test | 44 |
| Sample practical test projects | 44 |
| SAMPLE WRITTEN TEST QUESTIONS | 47 |
| RECOMMENDED STUDY MATERIALS | |
| Federal Aviation Regulations (FAR) | 55 |
| FAA Advisory Circulars | 55 |
| Miscellaneous FAA publications | 57 |


## APPENDIX


| | |
|---|---|
| FEDERAL AVIATION REGULATIONS | 59 |
| MAP SHOWING FAA REGIONS | 61 |
| FAA REGIONAL OFFICES AND FLIGHT STANDARDS DISTRICT OFFICES | 62 |

# INTRODUCTION

The requirements for a mechanic certificate and ratings, and the privileges, limitations, and general operating rules for certificated mechanics are prescribed in Federal Aviation Regulations Part 65—Certification: Airmen Other Than Flight Crewmembers. Any person who applies and meets the requirements is entitled to a mechanic certificate.

Briefly, the requirements for a mechanic certificate are concerned with age, language ability, experience, knowledge, and skill. The sections of this guide explain the procedure for either substantiating or demonstrating that each requirement has been met.

The sections that deal with the written test (to demonstrate knowledge) and the oral and practical tests (to demonstrate skill) describe the types of tests used and what they contain. The subject listings and the sample questions and projects should be helpful during preparation for the tests.

Portions of the Federal Aviation Regulations (FAR) concerning general eligibility and experience requirements for a mechanic certificate and ratings have been included. Since regulations are subject to amendment, applicants should be alert for changes that may have occurred since publication of this guide. Change information may be determined by referring to the most recent FAR Status Sheet mentioned in the Appendix, or by checking with an FAA Flight Standards district office. The FARs have been organized and printed in eleven volumes of interrelated Parts. Refer to the Appendix, FAR Status Sheet, for information about the FAR rearrangement.

FAA Flight Standards district offices are listed in the appendix and each office serves the geographical area in which it is located. Applicants should contact the most convenient office.

# ELIGIBILITY REQUIREMENTS FOR CERTIFICATION

Mechanic certificate requirements can be classified as general eligibility requirements, knowledge requirements, experience requirements, and skill requirements. The following excerpts from FAR Part 65 pertain to eligibility for a mechanic certificate and rating(s).

**"§ 65.71 Eligibility requirements: general.**

(a) To be eligible for a mechanic certificate and associated ratings, a person must—

(1) Be at least 18 years of age;

(2) Be able to read, write, speak, and understand the English language, or in the case of an applicant who does not meet this requirement and who is employed outside of the United States by a U.S. air carrier, have his certificate endorsed 'Valid only outside the United States';

(3) Have passed all of the prescribed tests within a period of 24 months; and

(4) Comply with the sections of this subpart that apply to the rating he seeks.

(b) A certificated mechanic who applies for an additional rating must meet the requirements of § 65.77 and, within a period of 24 months, pass the tests prescribed by § § 65.75 and 65.79 for the additional rating sought.

**"§ 65.75 Knowledge requirements.**

(a) Each applicant for a mechanic certificate or rating must, after meeting the applicable experience requirements of § 65.77, pass a written test covering the construction and maintenance of aircraft appropriate to the rating he seeks, the regulations in this subpart, and the applicable provisions of Parts 43 and 91 of this chapter. The basic principles covering the installation and maintenance of propellers are included in the powerplant test.

(b) The applicant must pass each section of the test before applying for the oral and practical tests prescribed by § 65.79. A report of the written test is sent to the applicant.

**"§ 65.77 Experience requirements.**

Each applicant for a mechanic certificate or rating must present either an appropriate graduation certificate or certificate of completion from a certificated aviation maintenance technician school or documentary evidence, satisfactory to the Administrator, of—

(a) At least 18 months of practical experience with the procedures, practices, materials, tools, machine tools, and equipment generally used in constructing, maintaining, or altering airframes, or powerplants appropriate to the rating sought; or

(b) At least 30 months of practical experience concurrently performing the duties appropriate to both the airframe and powerplant ratings."

The documentary evidence specified in § 65.77 may take any of various forms, such as letters from present and former employers, military service records, business records, etc., as long as the FAA inspector or advisor who reviews it is able to determine that the type and amount of experience meets the requirements.

**"§ 65.79 Skill requirements.**

Each applicant for a mechanic certificate or rating must pass an oral and a practical test on the rating he seeks. The tests cover the applicant's basic skill in performing practical projects on the subjects covered by the written test for that rating. An applicant for a powerplant rating must show his ability to make satisfactory minor repairs to, and minor alterations of, propellers.

**"§ 65.80 Certificated aviation maintenance technician school students.**

Whenever an aviation maintenance technician school certificated under Part 147 of this

chapter shows to an FAA inspector that any of its students has made satisfactory progress at the school and is prepared to take the oral and practical tests prescribed by § 65.79, that student may take those tests during the final subjects of his training in the approved curriculum, before he meets the applicable experience requirements of § 65.77 and before he passes each section of the written test prescribed by § 65.75."

## THE WRITTEN TESTS

The written tests required for a mechanic certificate or rating can be taken at FAA Flight Standards district offices and at some selected Flight Service Stations. Some Flight Standards district offices administer mechanic written tests at special locations by prior arrangement, and some Flight Service Stations often administer written tests after the normal workday and on weekends. Contact the local FAA district office for information about time and place where tests are administered.

Most FAA offices that administer written tests recommend that an appointment be made before the intended date of examination so that the appropriate personnel will be on hand to give the tests and to assure that adequate space is available.

An applicant must have the documentary evidence required by FAR 65.77 reviewed by an FAA inspector to confirm eligibility to take a written Airframe or Powerplant test. Those applicants found to be eligible for testing who are unable to take the test at that time may request the FAA inspector to issue an Airman Authorization for Written Test, FAA Form 8060–7.

When eligibility has been confirmed or the completed 8060–7 is presented and sufficient time exists (5 hours) to complete the test, the FAA office test monitor will issue a test booklet, a blank answer sheet, and all materials necessary to take the test. The applicant is not required to furnish any test or reference materials, nor permitted to use notes or take notes during the test.

Written tests for airframe and powerplant mechanic certification consist of three separate tests: (1) Aviation Mechanic General Test; (2) Aviation Mechanic Airframe, Section 1—Airframe Structures, and Section 2—Airframe Systems & Components; and (3) Aviation Mechanic Powerplant, Section 1—Powerplant Theory & Maintenance, and Section 2—Powerplant Systems & Components.

Applicants will not be required to take the Aviation Mechanic General Test required for Airframe and/or Powerplant certification if they can show that they have previously passed it. Proof of passing may be in the form of a mechanic certificate with an alternate rating or an Airman Written Test Report that shows a passing grade on the Aviation Mechanic General Test. If an Airman Written Test Report is used, the passing credit must have been earned within the preceding 24 months.

FAA mechanic written tests are made up of objective-type questions of the multiple-choice form. In this type of test, the applicant chooses the best of a number of possible answers to a question. Each of the FAA mechanic written test questions has one *best* answer and three wrong or unacceptable alternative answers. The tests do not contain questions designed to trick or mislead the applicant.

After completion of the test, the applicant's answer sheet is forwarded by the local FAA office to a central location for grading. The minimum passing grade for FAA tests is 70 percent. Written test grades are mailed directly to the applicant using the address entered by the applicant on the answer sheet at the time the test is taken. Five working days (exclusive of time en route in the mail) are normally required for answer sheets to be processed and grades reported.

## Written Test Report

Written test grades are reported to applicants on AC Form 8080–2, Airman Written Test Report. The report indicates the numerical grade for each test section and an expiration date of each test section passed. AC Form 8080–2 is the only acceptable evidence of having passed any part of the written test or the entire test.

In addition to grade information, the computer-rendered AC Form 8080–2 provides a coded print-out of the subject areas for which questions were answered wrong. The subject area codes indicated on AC Form 8080–2 correspond to the subject headings indicated on pages 7 through 42 of this advisory circular; however, the number of questions missed cannot be determined by the number of codes listed on AC Form 8080–2.

When an applicant applies for the oral and practical test, the Airman Written Test Report must be surrendered.

If the Airman Written Test Report is lost or destroyed, a duplicate copy may be obtained by sending $2.00 (money order or check payable to FAA) to the Federal Aviation Administration, Airman Certification Branch, P.O. Box 25082, Oklahoma City, Oklahoma 73125. Give the title of the test, the place where it was administered, and the approximate date that the test was taken.

An applicant who fails a test, or any section thereof, may apply for a retest of the test section(s) failed as prescribed in FAR Part 65. The following excerpts from § 65.19 pertain to retesting after failure.

### "§ 65.19 Retesting after failure.

An applicant who fails a written, oral, or practical test for a certificate and rating, or for an additional rating, under this Part may apply for retesting—

(a) After 30 days after the date he failed the test; or

(b) Upon presenting a statement from whichever of the following persons is applicable, certifying that he has given the applicant at least 5 hours of additional instruction in each of the subjects failed and now considers that the applicant is ready for retesting. . . . .

(3) For the mechanic certificate—a certificated and appropriately rated mechanic or ground instructor, or a certificated repairman who is experienced in the subject failed."

## AVIATION MECHANIC TEST CONTENTS

This listing of the subject material covered by the questions in the mechanic tests shows what the applicant should know and be able to do. Each listing contains major headings (identified by letters A, B, C, etc.) under which are listed one or more action lines. Each action line is made up of 3 elements: (1) the action, (2) the subject, and (3) the level. For instance, the major heading "C. Weight and Balance" in the General Test has two action lines:

(a) Weigh aircraft—Level 2.

(b) Perform complete weight and balance check and record data—Level 3.

The action lines tell what the end result or objective of the applicant's study and experience should be. Many action lines show more than one action and more than one subject.

The purpose of the level indicated for each action line is to help limit the amount of study that must be done or the skill that must be developed to pass the mechanic tests. Three levels have been identified. The higher the level, the more comprehensive the knowledge and skill required in that subject area. A Level 1 action line requires a less extensive knowledge of the subject and no skill demonstration to pass the mechanic tests. A Level 2 action line requires a fairly good understanding of the subject indicated, the theories and principles associated with it, and the ability to perform basic operations. Level 3, the highest level, requires a thorough knowledge of the subject and an understanding of how it relates to the total operation and maintenance of aircraft. The operations necessary to complete Level 3 items must be performed skillfully enough so that, if performed on an aircraft, the aircraft could be returned to service.

A detailed description of the meaning of each level is:

**Level 1:**

Know—basic facts and principles.

Be able to—find information and follow directions and written instructions.

No skill demonstration is required.

**Level 2:**

Know and understand—principles, theories and concepts.

Be able to—find and interpret information and perform basic operations.

A high level of skill is not required.

**Level 3:**

Know, understand, and apply—facts, principles, theories, and concepts. Understand how they relate to the total operation and maintenance of aircraft.

Be able to—make independent and accurate airworthiness judgments. Perform all operations to a return-to-service standard.

A fairly high skill level is required.

Following each action line is a list of statements that describe the specific subjects of mechanic test questions. They are intended to be used during study and while experience is being gained, to help direct the applicant's attention toward areas covered by the tests.

# AVIATION MECHANIC

## General Test

### A. BASIC ELECTRICITY.

**Measure capacitance and inductance.**—Level 1:

The effect of inductive reactance in an electrical circuit.

The interrelationship of capacitive and inductive reactance.

The term that describes the combined resistive forces in an a.c. electrical circuit.

The unit of measurement for capacitance and inductance.

**Calculate and measure electrical power.**—Level 2:

Determine the power furnished by a generator to an electrical system consisting of various electrical units having specific load ratings.

Determine the power required by an electric motor that is operating at a specified efficiency and load.

**Measure voltage, current, resistance, continuity, and leakage.**—Level 3:

Use an ohmmeter to check for open or short circuits.

The test instruments used to check continuity.

The basic operating principle of d.c. electrical instruments.

The basic operating principles of a galvanometer.

Connect voltmeters and ammeters into an electrical circuit.

The purpose of a shunt resistor when used with an ammeter.

The meaning of prefixes such as micro, mega, kilo, and milli as used in expressing electrical quantities.

**Determine the relationship of voltage, current, and resistance in electrical circuits.**—Level 3:

Determine the current flow in an electrical circuit using variable resistance and voltage values.

Determine the power requirements of an electrical circuit when the voltage and resistance values are specified.

The current relationship in a parallel electrical circuit.

The unit of measurement used to express electrical power.

The principles of electromagnetic induction.

The characteristics of magnets and magnetic lines of force.

The factors that affect the voltage drop in an electrical conductor.

Determine the resistance of an electrical device from the wattage and voltage values specified.

Calculate the voltage drop across a resistor.

**Read and interpret electrical circuit diagrams.**—Level 3:

Trace electrical circuits using aircraft wiring diagrams.

Identify electrical system malfunctions by reference to circuit diagrams.

Identify the commonly used aircraft electrical symbols.

**Inspect and service batteries.**—Level 3:

Remove spilled electrolyte and treat all adjacent surfaces.

Remove and install a battery in an aircraft with a single-wire electrical system.

Connect batteries to a constant-current battery charger.

Determine the specific gravity of the battery electrolyte.

Perform a high-rate-discharge condition test of batteries.

The design factors that affect battery voltage and capacity.

The factors that determine battery charging rate on a constant voltage source.

The indications of a shorted battery cell.

The significance of battery capacity ratings.

The effects of increased internal resistance on battery operation.

The effects of connecting battery cells in series or parallel.

The relative advantages of lead-acid and nickel-cadmium batteries for use in aircraft.

The principles of battery construction.

Check battery electrolyte levels.

The relationship between battery state of charge and the temperature at which the electrolyte will freeze.

The purpose of and requirements for ventilating batteries and battery compartments in civil aircraft.

The effect of excessive charging rates on batteries.

## B. AIRCRAFT DRAWINGS.

**Use drawings, symbols, and schematic diagrams.**—Level 2:

Interpret the various types of lines employed in blueprints and schematics.

Use schematic diagrams to analyze system malfunctions.

Extract a specific electrical circuit from a system drawing.

Know why dimensions are used and how they are shown on aircraft drawings.

Use installation diagrams to locate and identify components.

**Draw sketches of repairs and alterations.**—Level 3:

Illustrate a major repair or alteration.

Use dividers, compass, ruler, T-square, etc., in the development of sketches of repairs and alterations.

Use standard drafting procedures.

**Use blueprint information.**—Level 3:

The information presented in blueprint title blocks.

The common symbols used on aircraft blueprints.

Install and modify component parts by reference to blueprints.

Identify the changes made to a blueprint.

**Use graphs and charts.**—Level 3:

Determine electric cable size and current-carrying capacity.

Determine engine power requirements.

## C. WEIGHT AND BALANCE.

**Weigh aircraft.**—Level 2:

Use aircraft specifications for weighing purposes.

Locate jacks and scales in the correct position.

Prepare aircraft for weighing.

**Perform complete weight-and-balance check and record data.**—Level 3:

Determine that the forward or rearward center-of-gravity (c.g.) limit is not exceeded on a specified aircraft.

The point of reference for all weight-and-balance measurements.

The procedure for computing "minimum fuel."

Locate the information that should be known to compute weight and balance.

The method of expressing additions or removals of equipment for weight-and-balance purposes.

Determine the fully loaded center of gravity of an aircraft.

Determine the "maximum authorized weight" of an aircraft.

The method of determining aircraft empty weight, when engine oil and hydraulic fluid are contained in supply tanks.

The effect on weight and balance of replacing a component with another of different weight and location.

Calculate the maximum cargo or baggage weight that can be carried by an aircraft.

The record requirements for weight-and-balance data.

The hazards of exceeding aircraft fore and aft center-of-gravity limits.

The critical conditions of helicopter load and balance.

Determine aircraft empty weight and empty weight center of gravity.

Define maximum gross weight.

Determine the moment of an item of equipment.

Account for tare weight when weighing an aircraft.

## D. FLUID LINES AND FITTINGS.

**Fabricate and install rigid and flexible fluid lines and fittings.**—Level 3:

Single- and double-flare tubing.

Install Military Standard (MS) flareless fittings.

The significance of the identification stripes that appear on aircraft hose.

Fabricate and install beaded tubing.

Use lubricants and sealants in the assembly of lines and fittings.

Identify flexible hydraulic lines.

Install hose clamps.

Determine the bend radii for rigid tubing.

Fabricate aluminum tubing using standard AN flared tube fittings.

Route fluid lines in entryways and passenger, crew, or baggage compartments.

Repair metal tube lines.

Route fluid lines adjacent to electrical power cables.

Install rigid tubing.

Select tube-flaring tools.

Identify AN fitting materials from color designators.

The maximum reduction in original outside diameter allowed when bending aluminum alloy hydraulic lines.

The procedure to follow if scratches are detected on an aluminum alloy tube.

The storage requirements for hydraulic hose.

Install flexible hydraulic hose.

The lubricant used when assembling oxygen fittings.

## E. MATERIALS AND PROCESSES.

**Identify and select appropriate nondestructive testing methods.**—Level 1:

The use of radiography in aircraft and component inspection.

The use of ultrasonic inspection methods for detecting cracks.

The applicability of magnetic particle inspection methods to engine crankshafts.

The method for detecting surface cracks in aluminum castings and forgings.

The technique for locating cracks in materials when only one side of the material is accessible.

**Perform penetrant, chemical etching, and magnetic particle inspections.**—Level 2:

The general procedure for performing magnetic particle inspection.

Demagnetize steel parts after magnetic particle inspection.

Clean parts in preparation for penetrant inspection.

The visual indications of a subsurface flaw or fracture during magnetic particle inspection.

Locate cracks and blowholes in welded assemblies.

The procedure for using dye penetrants.

Distinguish between heat-treated and non-heat-treated aluminum alloys when the identification marks are not on the material.

**Perform basic heat-treating processes.**—Level 2:

The types of aluminum alloys considered to be heat treatable.

Anneal copper tubing.

The steps in heat treatment of aluminum alloys.

The effects of various forms of heat treatment.

The effect of incorrect heat treatment on the corrosion-resistant properties of aluminum alloy.

Identify the degree of temper for aluminum alloy products from code designators.

The effect of heating a metal slightly above its critical temperature, and then rapidly cooling it.

The effect of strain hardening on the tensile strength of aluminum alloy.

The relationship between tensile strength and metal hardness.

Anneal a welded steel part.

**Identify and select aircraft hardware and materials.**—Level 3:

Identify aluminum alloys from code designators.

Identify steel from code designators.

The identification markings of AN standard steel bolts.

Identify aircraft cable.

The characteristics of a material that affect its ability to be hammered, rolled, or pressed into various shapes.

The SAE system of identifying steel.

Determine wrought aluminum alloy composition and condition by referring to aluminum codes.

Install self-locking nuts.

Determine the correct length bolt to use.

Determine correct torque values for tightening aircraft nuts and bolts.

Determine rivet composition, condition, shape, and dimension by referring to rivet code.

Identify materials suitable for use for firewalls and exhaust shrouds.

Install castle nuts.

The strength characteristics of type "A" rivets.

The characteristic of aluminum alloy rivet material that causes some rivets to require several days to reach their ultimate strength.

Determine that materials used in aircraft maintenance and repair are of the proper type and conform to the appropriate standards.

The characteristics of aluminum-clad sheet aluminum alloy.

**Inspect and check welds.**—Level 3:

The characteristics of a good weld.

The types of stress that welded joints can withstand.

The effect of welding over a previously brazed or soldered joint.

**Perform precision measurements.**—Level 3:

Use a micrometer and a caliper to make precise measurements.

Measure a small hole using a micrometer and a hole gage.

Read and interpret a vernier micrometer scale.

Use a dial indicator, V-blocks, and a surface plate to check alignment of a shaft.

## F. GROUND OPERATION AND SERVICING.

**Start, ground operate, move, service, and secure aircraft.**—Level 2:

The procedure for extinguishing fires in the engine induction system during starting.

Use hand signals to direct aircraft movement.

Select and use external auxiliary power units for engine starting.

Tie down and secure aircraft for outside storage.

Protect aircraft fuel system from contamination during fueling operations.

Connect and operate an external source of hydraulic power.

Start and operate an engine equipped with a float-type carburetor.

Check a reciprocating engine for liquid lock.

Operate hand and electrical priming systems during engine starting.

Start and operate an engine equipped with a pressure injection carburetor.

Start and operate an engine equipped with an internal supercharger.

**Identify and select fuels.**—Level 2:

The effect of ethylene dibromide added to aviation gasoline.

The identifying color of various grades of aviation gasoline.

The characteristic of a fuel that affects its tendency to "vapor lock."

The significance of the numbers used to designate various grades of aviation gasoline.

The relative advantages of gasoline and kerosene for use as fuel for turbine engines.

Determine the type of fuel to be used with a specified aircraft.

The factors affecting the antiknock characteristics of fuel.

## G. CLEANING AND CORROSION CONTROL.

**Identify and select cleaning materials.**—Level 3:

The effect of caustic cleaning products on aluminum structures.

The characteristics and use of chemical cleaners.

Clean aluminum and steel engine parts.

The type cleaner for use on high-strength metals.

The methods for cleaning turbine engine compressor blades.

**Perform aircraft cleaning and corrosion control.**—Level 3:

Protect tires and other rubber products from the deteriorating effects of cleaning materials.

The cause and corrective procedures for fretting corrosion.

Identify and control intergranular corrosion of heat-treated aluminum alloy.

Protect structure against dissimilar-metal corrosion.

Prevent and remove rust.

The effect of oily, dirty surfaces on the operation of high-performance aircraft.

Protect interior surfaces of closed steel and aluminum tubing against corrosion.

The methods of protecting aluminum alloy parts against corrosion.

Clean and protect battery compartments and adjacent areas.

Remove corrosion products such as metal flakes, scale powder, and salt deposits from aluminum.

Clean corrosion-resistant parts by blast cleaning methods.

Use paints and similar organic coatings for corrosion protection purposes.

## H. MATHEMATICS.

**Extract roots and raise numbers to a given power.**—Level 1:

The method of determining the square or cube of a number.

The procedure for determining square root.

**Determine areas and volumes of various geometrical shapes.**—Level 2:

Calculate the area of rectangles, squares, triangles, circles and trapezoids.

Determine the volume of rectangles, cubes, and cylinders.

Compute the surface area of an airfoil.

Determine cylinder displacement of a reciprocating engine.

**Solve ratio, proportion, and percentage problems.**—Level 3:

Determine the ratio of two numbers.

Find what percent one number is of another.

Determine the rate percent of a given number.

Calculate the compression ratio of an engine.

Convert decimal numbers to their fractional equivalent.

**Perform algebraic operations involving addition, subtraction, multiplication, and division of positive and negative numbers.**—Level 3:

Locate the main-wheel weighing point with reference to the datum.

Determine the distance between the tail or nose gear and the main-wheel weight point.

Calculate the c.g. relative to the datum.

The effects of adding or removing equipment on the empty weight of the aircraft.

## I. MAINTENANCE FORMS AND RECORDS.

**Write descriptions of aircraft condition and work performed.**—Level 3:

Describe the repairs made to an aircraft structure.

State aircraft condition based upon inspection.

**Complete required maintenance forms, records, and inspection reports.**—Level 3:

Enter the required information in the permanent maintenance records when a minor repair has been performed.

Prepare and properly dispose of FAA Form 337.

The minimum information required to be entered in the maintenance records after maintenance or alteration of aircraft.

Make record entries to indicate compliance with Airworthiness Directives.

The definition of "time in service" with respect to maintenance records.

The record requirements for returning aircraft to service after 100-hour inspection.

The requirement for maintaining a permanent record of aircraft maintenance.

The definition of "repair" as related to aircraft maintenance.

The requirements for a permanent maintenance record.

## J. BASIC PHYSICS.

**Use the principles of simple machines; sound, fluid, and heat dynamics.**—Level 2:

The relationship between temperature and heat.

The methods of heat transfer.

The forces acting upon a body in circular motion.

The relationship between the pressure and the rate-of-flow of a liquid through an orifice.

The relationship between the pressure, volume, and temperature of an air mass.

The relationship of work, force, and power.

The effect of air density on engine power output.

The relationship between air velocity and pressure on the upper surface of an airfoil.

The effect of atmospheric temperature and humidity on airfoil lift.

The principles of transmission of power in a hydraulic system.

The relationship of pressure, area, and force.

## K. MAINTENANCE PUBLICATIONS.

**Select and use FAA and manufacturer's aircraft maintenance specifications, data sheets, manuals, and publications, and related Federal Aviation Regulations.**—Level 3:

Determine the suitability of a propeller for use with a particular engine-airplane combination.

Determine the minimum diameter of a propeller type and model when used with a particular engine.

Locate aircraft leveling and weighing information.

Determine engine/propeller speed ratios.

The instrument markings required on a specified type and model aircraft.

The purpose and applicability of Technical Standard Orders.

The purpose and applicability of Supplemental Type Certificates.

Identify the useful load and empty weight c.g. of an aircraft by reference to data.

Use FAA Specifications and Type Certificate Data Sheets.

The applicability and requirements for aircraft airworthiness certificates

Determine the control surface movement limits of a specified aircraft.

Determine seat locations of an aircraft, using aircraft specifications.

Use aircraft listing to find information about aircraft of limited production.

The purpose and applicability of FAA Airworthiness Directives.

Use "Table of Limits" to determine condition of parts.

**Read technical data.**—Level 3:

Find specified information in technical reports and manuals.

## L. MECHANIC PRIVILEGES AND LIMITATIONS.

**Exercise mechanic privileges within the limitations prescribed by FAR 65.**—Level 3:

The criteria for determining the classification (major, minor, or preventive maintenance) of airframe repairs and alterations.

The criteria for determining the classification (major, minor, or preventive maintenance) of powerplant repairs and alterations.

The criteria for determining the classification (major, minor, or preventive maintenance) of propeller repairs and alterations.

Return an aircraft to service after installation of an engine type other than that for which the aircraft was originally certificated.

The minimum age requirement for issuance of a mechanic certificate.

The privileges of a mechanic in relation to 100-hour and annual inspections.

The requirements for reporting change of address.

The duration or effective period of a mechanic certificate.

The requirements an applicant must meet for issuance of a mechanic certificate.

Determine the maintenance classification (major repair, minor repair, preventive maintenance) of landing gear tire removal, installation, and repair.

Determine the maintenance classification (major repair, minor repair, preventive maintenance) of servicing landing gear shock struts.

Determine the repair classification (major repair, minor repair, preventive maintenance) of repairs to steel tubing structures by welding.

Determine the repair classification (major repair, minor repair, preventive maintenance) of replacing the fabric on fabric-covered parts such as wings, fuselages, stabilizers, and control surfaces.

The recency-of-experience requirements for certificated mechanics.

The privileges of a mechanic regarding return to service of aircraft after major repairs.

Determine the maintenance classification (major repair, minor repair, preventive maintenance) of the replacement of aircraft components with new, rebuilt, or repaired components of similar design.

## AVIATION MECHANIC AIRFRAME TEST

### Section 1. Airframe Structures

### A. WOOD STRUCTURES.

**Service and repair wood structures.**—Level 1:

The general requirements of scarf splice joints.

The repair procedure for elongated holes in wood spars.

The permissible wood substitutes for use in making repairs to wood structures.

The procedures for repairing wood rib capstrips.

The characteristics of glue used in aircraft construction and repair.

The procedure for sealing the inner surfaces of a wooden structure that is to be assembled by gluing.

The general characteristics of the wood commonly used in aircraft construction.

**Identify wood defects.**—Level 2:

Recognize acceptable and nonacceptable wood defects.

**Inspect wood structures.**—Level 2:

The effect of moisture content on wood size and strength.

The strength characteristics of wood structures.

The characteristics of plywood and laminated wood.

### B. AIRCRAFT COVERING.

**Select and apply fabric and fiberglass covering materials.**—Level 1:

The factors to consider in selecting aircraft fabric.

The types of seams commonly used in aircraft fabric coverings.

The general requirements for making doped and lapped seams.

The meaning of the term "warp" as used in reference to aircraft textile products.

The precautions to observe when installing surface tape on control surfaces.

**Inspect, test, and repair fabric and fiberglass.**—Level 3:

Determine the condition of aircraft fabric.

Apply a doped-on patch to aircraft fabric.

Make a sewed repair to a fabric-covered surface.

The areas on a fabric-covered aircraft most susceptible to corrosion.

### C. AIRCRAFT FINISHES.

**Apply trim, letters, and touchup paint.**—Level 1:

The requirements for registration markings.

The relative proportions of identification markings.

The use of color and ornamentation when applying registration marks.

**Identify and select aircraft finishing materials.**—Level 2:

The characteristics of butyrate and acetate dopes.

The types of thinners used with various types of paint and dope.

The characteristics of fabric rejuvenators.

The types of priming paints generally used on aircraft.

The type paint used to coat the insides of battery compartments.

**Apply paint and dope.**—Level 2:

The purpose of fungicidal dope in aircraft finishing.

The application of rejuvenator to repair an aged dope finish.

The products and methods used to dope-proof airframe structures.

The effect of atmospheric conditions on dope during its application.

Sand and rub aircraft finishes.

Apply primer to aluminum alloy parts.

Use and maintain a paint spray gun.

The purpose of brushing the first coat of dope instead of spraying.

**Inspect finishes and identify defects.**—Level 2:

The type of painting defect caused by moving the spray gun in an arc instead of a straight line.

The cause of runs and sags in aircraft finishes.

## D. SHEET METAL STRUCTURES.

**Install special rivets and fasteners.**—Level 2:

Determine correct rivet length and diameter.

Install a hi-shear rivet.

The precautions concerning rivet fit.

Install deicer boot fasteners.

Install blind-type rivets.

The stresses that a rivet is designed to resist.

**Inspect bonded structures.**—Level 2:

The reason for using metal sandwich panels in high-speed aircraft construction.

The use of the metallic "ring" test to inspect for delamination damage of bonded structures.

Evaluate the extent of damage to a bonded structure and determine the type repair needed.

**Inspect and repair plastics, honeycomb, and laminated structures.**—Level 2:

Distinguish between transparent plastic and plate-glass enclosures.

Protect plastics during handling and repair operations.

Remove scratches and surface crazing from plastic enclosures.

Drill shallow or medium depth holes in plastic materials.

The effect of moisture entrapped in honeycomb structures.

Use a router to remove damaged area from honeycomb panels.

Clean honeycomb panels prior to patching.

**Inspect, check, service, and repair windows, doors, and interior furnishings.**—Level 2:

Clean transparent plastic window and windshield materials.

Inspection procedures and airworthiness requirements for safety belts.

The characteristics of acrylic plastic enclosure materials.

Maintain safety belts.

Secure transparent plastic enclosures to the aircraft structure.

Protect transparent plastic enclosure materials during handling and storage.

The physical characteristics of transparent plastic enclosure materials.

Form and shape acrylic plastic.

Repair shallow surface scratches in transparent plastic enclosures.

**Inspect and repair sheet-metal structures.**—Level 3:

Select and use twist drills.

Select and use a hand file for soft metals.

Prepare dissimilar metals for assembly.

Determine the type, size, and number of rivets for use in structural repairs.

Repair sheet-metal flight control surfaces.

The loads acting upon a semimonocoque fuselage.

The construction characteristics of monocoque and semimonocoque structures.

The construction characteristics of cantilever wing structures.

The types of loads carried by wing spars.

Drill holes in stainless steel.

Define bearing failure as related to sheet-metal structures.

Define shear failure.

Repair a hole in a stressed-skin metal wing.

Repair a section of damaged skin using a single-lap sheet splice.

Construct a watertight joint.

Countersink a hole.

Perform the dimpling process.

Select the correct rivet to accomplish a repair using a specified material.

Repair or splice stringers on the lower surface of a stressed-skin metal wing.

Determine the correct rivet layout and spacing for a specified repair.

Use proper riveting techniques.

Stop drill cracks in sheet metal.

Repair a slightly oversize hole.

Repair structural units, such as spars, engine supports, etc., that have been built from sheet metal.

Repair shallow scratches in sheet metal.

Determine the condition of a stressed-skin metal structure that is known to have been critically loaded.

Use a reamer.

**Install conventional rivets.**—Level 3:

Prepare sheet metal for installation of flush rivets.

Identify and select rivets.

Determine the correct rivet length and diameter.

Select and use the correct rivet set for specified rivet head styles.

Select and use bucking bars.

Remove rivets.

Determine the condition of a driven rivet.

Determine the circumstances under which 2117 rivets may be used to replace 2017 and 2024 rivets.

Define rivet tipping.

Determine the correct number of rivets to be used in making a structural sheet-metal repair.

Handle and install rivets that require heat treatment prior to use.

Adjust and use an air-operated riveting gun.

The circumstances under which type "A" rivets may be used in aircraft.

The mechanical properties of heat-treated rivets.

**Hand form, lay out, and bend sheet metal.**—Level 3:

Make a joggle or offset bend.

Bend sheet metal that requires the use of a large radius.

Determine the neutral axis of a bend.

Define bend radius.

Determine the amount of material required to make a specified bend.

Bend sheet metal to a specified angle.

Lay out and bend a piece of sheet metal using a minimum radius for the type and thickness of material specified.

Lay out a bend in relationship to metal "grain" to minimize the possibility of cracking.

Determine the flat layout dimensions of a component part to be formed by bending.

Form metal by bumping.

## E. WELDING.

**Weld magnesium and titanium.**—Level 1:

The method of cleaning magnesium in preparation for welding.

The main function of a flux while welding magnesium.

The types of gases to use when gas-welding magnesium.

The use of butt joints when gas-welding magnesium.

**Solder stainless steel.**—Level 1:

The use of silver soldering as a method of bonding metals.

The preparation of stainless steel for soldering.

The methods of cleaning material after soldering.

**Fabricate tubular structures.**—Level 1:

The types of tubing splices.

The proper welding sequence to use when welding fuselage tubes.

The characteristics of a welded tubing joint.

The protection of the interior of tubular steel that is to be closed by welding.

The methods used to control distortion of steel tube structures during welding repairs.

The preparation of tube ends for welding.

**Solder, braze, gas-, and arc-weld steel.**—Level 2:

Use cleaning operations to prepare sheet steel for welding.

Adjust oxyacetylene welding torch to produce the type flame needed to weld a specified material.

Select and use filler rod.

The effect of excessive heat on metal.

Operate a portable welding set.

Select the correct size welding torch tip.

The precautions regarding welding over a previously brazed or soldered joint.

Solder a wire or cable to an electrical component.

Sweat-solder a lap joint.

Normalize a steel part after welding.

Identify steel parts considered to be repairable by welding.

The preheating required prior to welding.

**Weld aluminum and stainless steel.**—Level 2:

Use a filler rod when welding aluminum with oxyacetylene.

Use flux when welding aluminum.

The purpose and effect of using inert gas to shield the arc in certain types of welding.

## F. ASSEMBLY AND RIGGING.

**Rig rotary-wing aircraft.**—Level 1:

The condition of flight that a properly rigged aircraft should maintain.

The relationship of thrust and drag of an aircraft during level unaccelerating flight.

The relationship of lift and weight of an aircraft during level unaccelerating flight.

The meaning of the term "angle of attack" of an airfoil.

The type of control movement used to induce forward flight in a helicopter.

The method of controlling vertical flight of a helicopter.

The movement of an aircraft about its axes during normal flight maneuvers.

The factors affecting stability of an aircraft about its axes.

The methods of maintaining directional control of a helicopter.

The cause and effect of rotor blade stall in helicopters operating at high speeds.

The cause of vertical vibration in a two-blade helicopter rotor system.

The preparations required prior to rigging.

The method of tracking helicopter main rotor blades.

**Rig fixed-wing aircraft.**—Level 2:

The condition of flight that a properly rigged aircraft should maintain.

The factors to consider when rigging vertical stabilizer of single-engine, propeller-driven aircraft.

The relationship of thrust and drag of an aircraft during level unaccelerating flight.

The effect of incorrect wing incidence angle.

The effect of dihedral on aircraft stability.

Use wing "wash-in" and "wash-out" to correct aircraft rigging.

The relationship of lift and weight of an aircraft during level unaccelerating flight.

The meaning of the term "angle of attack" of an airfoil.

The effect of flaps on aircraft landing speed and approach angle.

The meaning of the term "incidence angle" of an airfoil.

The movement of an aircraft about its axes during normal flight maneuvers.

The relationship between the center of pressure of a wing and its angle of attack.

The factors affecting stability of an aircraft about its axes.

The usual location of aircraft c.g. in relationship to center of lift.

The changes in lift and drag of the wings when an aircraft is rolled about its longitudinal axis.

The procedure for establishing wing angle of incidence prior to repairing wing attachment fittings.

**Check alignment of structures.**—Level 2:

Prepare fuselage for alignment check.

Check alignment of internally braced wing structure.

The significance and method of expressing reference positions.

Check alignment of assembled aircraft.

**Assemble aircraft.**—Level 3:

The methods of safetying aircraft screws, bolts, and nuts.

Assemble, adjust, and safety cable turnbuckles.

The correct method of inserting bolts in aircraft fittings.

Install and inspect swaged cable terminals and fittings.

**Balance and rig movable surfaces.**—Level 3:

The inspection requirements for cable-operated primary flight control systems.

Handle and make up control cables.

The corrosion protection requirements of control cables.

The effect of overtightening control cables.

The relationship between specified movements of the cockpit controls and the control surfaces.

The relationship between specified control movements during flight and the movement of the aircraft about its axes.

The movement of the controls, control surfaces, and the aircraft about its axes during normal flight maneuvers.

Balance control surfaces after repair.

The relationship between specified movements of the trim tab operating device and the trim tab.

Secure the cockpit flight controls in preparation for control surface rigging.

The effect of a worn pulley in a cable-operated control system.

The means used to reduce or prevent control surface flutter.

The purpose and operation of control surface locks.

The purpose and operation of differential controls.

The purpose and applicability of fairleads in a cable-operated control system.

Install and rig the cables in a flight control system.

Splice control cables using Nicopress sleeves.

The probable causes of control surface flutter.

The maintenance requirements of control surface trim tab systems.

The purpose of counterweights incorporated into the leading edges of some primary control surfaces.

The purpose and function of "spring tabs" and "servo tabs".

Measure control surface movement and adjust control stops.

The effect of temperature changes on control system cable tension.

Assemble, adjust, inspect, and safety push-pull tube-type flight control systems.

The types and characteristics of cables used in aircraft primary control systems.

**Jack aircraft.**—Level 3:

Determine maximum allowable jacking weight.

The use of correct capacity jacks.

Protect aircraft from damage during lifting and lowering operations.

Use ballast when jacking aircraft with engine removed.

The effects of wind when jacking aircraft.

## G. AIRFRAME INSPECTION.

**Perform airframe conformity and airworthiness inspections.**—Level 3:

The maximum period of time an aircraft can be flown before an annual inspection is required.

Determine the condition of airframes, airframe systems, and components.

The primary purpose of inspection.

The maximum time an aircraft that carries passengers for hire or is used in flight instruction can be flown before being inspected.

Determine that an aircraft is in conformity with FAA Specifications.

Determine that applicable Airworthiness Directives have been complied with.

Conduct a thorough and detailed inspection of an aircraft.

## AVIATION MECHANIC AIRFRAME TEST

### Section 2. Airframe Systems and Components

**A. AIRCRAFT LANDING GEAR SYSTEMS.**

**Inspect, check, service, and repair landing gear, retraction systems, shock struts, brakes, wheels, tires, and steering systems.** —Level 3:

Determine aircraft tire inflation pressures.

The factors affecting the retreading of aircraft tires.

Adjust landing gear toe-in.

Install and remove aircraft wheel and brake assemblies.

Install tubes and tires.

Protect aircraft tires from hydraulic fluids.

Service brake deboosters.

Service landing gear shock struts.

The effects of increasing temperature on "parked" brakes.

Determine the cause of an oleo strut bottoming during taxi operations.

The pressure source for actuating power brakes.

Select and install air valves in oleo shock struts.

Observe safety precautions when demounting tire and wheel assemblies.

Determine if a brake system requires bleeding; perform brake system bleeding.

Inspect and adjust multiple-disc brakes.

Install new linings in hydraulically operated single-disc brakes.

Determine the cause of spongy brake action.

Inspect and service aircraft tires and tubes.

Determine the reason for "dragging" brakes.

The method of equalizing braking pressure on both sides of the rotating disc of a single-disc brake.

Operate and check retractable landing gear.

Determine the cause of fading brakes.

Replace actuating cylinders.

Install brake blocks in an expander-tube brake assembly.

Inspect brake drums.

The purpose and function of metering pins in oleo shock struts.

Determine the cause of excessive brake pedal travel.

The operating principles of oleo shock struts during landing.

The storage requirements for aircraft tires and tubes.

The effect of a broken return spring in a brake master cylinder.

Determine the cause of grabbing brakes.

The purpose and operation of a debooster in a hydraulic power brake system.

Detect internal leakage in a brake master cylinder.

The operating principles of servo, expander-tube, multiple-disc, and single-disc aircraft brakes.

The purpose and operating principles of brake master cylinders.

**B. HYDRAULIC AND PNEUMATIC POWER SYSTEMS.**

**Repair hydraulic and pneumatic power system components.**—Level 2:

Install packing seals and rings on hydraulic components.

Determine the correct seal type to use with ester-base, petroleum-base, and vegetable-base fluids.

Remove and install hydraulic selector valves.

Remove and install a spool-type or balanced-type pressure regulator.

Determine the cause of excessive oil in an aircraft pneumatic power system.

The operating principles of a pneumatic power system multistage reciprocating compressor.

Identify hydraulic seals and packings.

Protect packing rings or seals against thread damage during installation.

**Identify and select hydraulic fluids.**—Level 3:

Determine the fluid type for use in a specified aircraft hydraulic system.

The method of measuring the viscosity of a liquid.

Identify ester-base, petroleum-base, and vegetable-base fluids.

**Inspect, check, service, troubleshoot, and repair hydraulic and pneumatic power systems.**—Level 3:

Determine the air pressure in a hydraulic accumulator.

The location and use of quick-disconnect fittings in hydraulic and pneumatic systems.

The mounting position of diaphragm and bladder-type hydraulic accumulators.

Service hydraulic reservoirs.

Determine the causes of incorrect system pressure.

Service porous paper and micronic filtering elements.

Adjust the pressure setting of the main system relief valve.

Purge air from a hydraulic system.

The term used to indicate force per unit area.

Identify the types of hydraulic power systems.

The purpose, location, and operation of a hydraulic fuse.

Protect a hydraulic system against contamination during a component replacement.

Inspect a hydraulic system for water and metal contamination.

Service a pneumatic system moisture separator.

The purpose, location, and operation of an orifice check valve in the wing flap actuating system.

The purpose, location, and operation of a wing flap overload valve.

The purpose, location, and operation of a hydraulic system pressure regulator.

The purpose, location, and operation of a sequence valve.

The purpose, location, and operation of a crossflow valve.

The purpose, location, and operation of a hydraulic system pressure accumulator.

The purpose, location, and operation of a shuttle valve.

The purpose, location, and operation of a check valve.

Install and remove engine-driven hydraulic pumps.

The indications of a worn or damaged hydraulic pump shaft.

The operating principles of hydraulic hand pumps.

The cause of hydraulic pump chatter during operation.

The operating principles of a constant-displacement hydraulic pump.

The operating principles of a variable-displacement hydraulic pump.

The purpose of the shear section on the shaft of an engine-driven hydraulic power pump.

The purpose and operation of a hydraulic actuating cylinder.

Determine the cause if a constant-pressure hydraulic system with no external leakage will not hold pressure when the power pump is not operating.

Determine the cause if an engine-driven power pump will not maintain system pressure during the actuation of a unit in the system.

The general features and operating principles of aircraft pneumatic power systems.

The purpose of pressurized reservoirs in some hydraulic systems.

The purpose and location of a standpipe in some hydraulic reservoirs.

The causes of too frequent cycling of a constant-pressure hydraulic system.

Operate and check a hydraulically operated flap system.

The operating mechanism of most hydraulic pressure gauges.

The indications of a low fluid supply during system operation.

## C. CABIN ATMOSPHERE CONTROL SYSTEMS.

**Repair heating, cooling, air-conditioning, pressurization, and oxygen system components.**—Level 1:

The usual reasons a surface combustion heater fails to operate.

The effects of cracks or holes in an exhaust-type heat exchanger.

The usual sources of contamination of a freon system.

The method of protecting a freon system from contamination during replacement of a component.

**Inspect, check, troubleshoot, service, and repair heating, cooling, air-conditioning, and pressurization systems.**—Level 1:

The operating principles of a thermostatically controlled surface combustion heater.

The methods used to control cabin pressure of a pressurized aircraft.

The protective features included in the control circuits of surface combustion heaters.

The purpose and operation of check valves in the delivery air ducts of a pressurization system.

The basic principles of providing and controlling aircraft pressurization.

The inspection requirements of cabin heating systems that utilize an exhaust heat exchanger as a source of heated air.

The method of checking a combustion heater fuel system for leaks.

The function of the condenser in a freon cooling system.

The function of the evaporator in a freon cooling system.

The function of an expansion valve in a freon cooling system.

The location, in relationship to each other, of the units in a freon cooling system.

The method of determining the liquid level in a vapor-cycle cooling system.

The procedure for servicing a vapor-cycle air-conditioning system that has lost all its freon charge.

The basic operating principles of an air-cycle cooling system.

The function of a jet pump in a pressurization and air-conditioning system.

The function of a mixing valve in an air-conditioning system.

The function of the negative pressure-relief valve in a pressurization system.

The function of the outflow valve in a pressurization system.

The function and principles of operation of an automatic cabin rate-of-climb control system.

**Inspect, check, troubleshoot, service and repair oxygen systems.**—Level 2:

Check oxygen system for leakage.

Service oxygen system with breathing oxygen.

Inspect a breathing oxygen system for contamination.

## D. AIRCRAFT INSTRUMENT SYSTEMS.

**Inspect, check, service, troubleshoot, and repair heading, speed, altitude, time, attitude, temperature, pressure, and position indicating systems.**—Level 1:

The procedure for "swinging" an aircraft magnetic compass.

The methods used to test a static air system for leakage.

The significance of various types of marks on the face of an instrument.

The operating principles of a thermocouple temperature-indicating circuit.

The service requirements of instrument system filters.

The effect of a ruptured or disconnected static pressure line located inside a pressurized cabin.

**Install instruments.**—Level 2:

The installation and connection of shock-mounted vacuum instruments to their power system.

The types of hardware used to install instruments.

The application of operation markings to the glass face of an aircraft instrument.

The protection of instruments during handling.

The installation practices necessary to prevent damaging an instrument.

The installation practices used in making hose or tubing connections to the instruments.

## E. COMMUNICATION AND NAVIGATION SYSTEMS.

**Inspect, check, and service autopilot and approach control systems.**—Level 1:

The operating principles of the sensing device used in an autopilot system.

The purpose and operation of the autopilot.

The purpose of a servomotor in an autopilot system.

The installation requirements for autopilot units.

The function of a position transmitter in an autopilot system.

**Inspect, check, and service aircraft electronic communication and navigation systems.**—Level 1:

The FCC regulations pertaining to the operation of two-way radio.

The principal conditions which must be considered in the installation of radio.

The protection of radio equipment from shock and vibration.

The methods of reducing engine noise in radio receivers.

**Inspect and repair antenna and electronic equipment installations.**—Level 2:

The preferred location and methods of mounting external antennas.

The procedure for returning an aircraft to service after a radio installation has been made in accordance with approved installation data.

The preferred location for the VOR localizer receiver antenna on a small aircraft.

## F. AIRCRAFT FUEL SYSTEMS.

**Check and service fuel dump systems.**—Level 1:

The reasons for requiring fuel dump systems.

The methods used to control the operation of fuel dump chutes and valves.

The principal safety requirements for a fuel dump system.

The purpose of jettison pumps in fuel dump systems.

**Perform fuel management, transfer, and defueling.**—Level 1:

The precautions required when defueling an aircraft.

The tank-to-engine combinations possible with a crossfeed system.

The method of maintaing c.g. limits using fuel transfer technique.

The arrangement of fuel system controls, indicators, and warning lights.

**Inspect, check, and repair pressure fueling systems.**—Level 1:

The method of controlling fuel level during pressure fueling operations.

The methods used to operate fueling valves.

The protection of integral tanks against overpressure during pressure fueling operations.

The arrangement of fueling system controls, indicators, and warning lights.

The precautions required when fueling an aircraft.

The purpose and operation of pilot valves.

**Repair aircraft fuel system components.**—Level 2:

Repair and seal fuel tanks.

Pressure test fuel tanks.

Remove and clean fuel strainers.

The precautions to follow when routing fuel lines.

The method of regulating fuel system pressure.

**Inspect and repair fluid quantity indicating systems.**—Level 2:

The methods used to determine the level of fluid in a tank.

The purpose of remote-reading electrical gages.

Calibrate liquidometer-type fluid quantity indicating systems.

The effect of aircraft attitude on fluid level measuring devices.

**Troubleshoot, service, and repair fluid pressure and temperature warning systems.**—Level 2:

Determine and adjust the pressure or temperature at which warning systems operate.

Determine the cause of incorrect warning system indications and make corrections.

Test the operation of temperature and pressure warning systems.

**Inspect, check, service, troubleshoot, and repair aircraft fuel systems.**—Level 3:

The fuel system inspection requirements for aircraft operating in areas of high humidity or wide temperature changes.

The design and installation requirements for aircraft fuel tanks.

The maintenance requirements of fuel tank sumps.

The marking requirements for fuel filler openings.

The purpose of potassium dichromate in a fuel system.

The reason for using booster pumps with engine-driven pumps.

The purpose of baffle plates in fuel tanks.

The installation and operation requirements of fuel valves.

The venting requirements of interconnected fuel tanks.

## G. AIRCRAFT ELECTRICAL SYSTEMS.

**Repair aircraft electrical system components.**—Level 2:

Use a "growler" in generator and motor armature inspection and repair.

Check the condition of shunt and compound generator field circuits.

Locate and use overhaul information for electrical equipment.

The procedures for correcting generator brush arcing.

Dress or turn the commutator surface of a motor or generator armature.

Flash a generator field.

The effect of changes in speed and load on generator output.

The function of a commutator in a direct current electric motor.

Seat new or replacement generator brushes.

The effect of incorrect generator brush spring tension on generator operation.

The methods of reducing armature reaction in aircraft generators.

The operating principles of carbon-pile voltage regulators.

The design factors that determine the number of cycles-per-revolution an alternating current generator will produce.

Determine the speed (r.p.m.) of an electric motor.

The basic principles of generators.

The factors that affect the torque produced by an electric motor.

The methods used to protect armature shafts from overloads.

The speed and load characteristics of series-, compound-, and shunt-wound motors.

The means employed to control current and voltage output of aircraft generators.

The methods used to control output frequency and voltage of alternating current generators.

The general operating characteristics of vibrator-type current and voltage regulators.

The purpose and operation of reverse-current cutout relays in generator control circuits.

The basic internal electrical circuits of series-, compound-, and shunt-wound generators.

The operating principles of magnetic clutches and brakes commonly used with electric motors.

The purpose and operation of reversible electric motors.

**Install, check, and service airframe electrical wiring, controls, switches, indicators, and protective devices.**—Level 3:

The purpose, applicability, and operation of electrical fuses and circuit breakers.

The types and operation of electrical switches.

Install and wire electrical switches.

Splice wiring in aircraft electrical systems.

The characteristics of high-tension and low-tension electrical wiring.

The purpose, applicability, and use of electrical wiring terminal strips.

The criteria for selecting aluminum and copper electrical cables.

Replace terminals on aircraft aluminum and copper electrical cables.

Determine the current-carrying capacity of an electrical circuit.

The installation and maintenance of open wiring electrical systems.

Install electrical wiring in conduits.

The method of protecting electrically operated emergency systems from accidental actuation.

The strength requirements for electrical cable terminals.

Select and install electrical bonding jumpers.

The installation requirements for electrical junction boxes.

The characteristics of single-wire electrical systems.

The special requirements an electrical bonding jumper must meet if it is required to carry a ground load for a unit of electrical equipment.

The purpose of shielding electrical wiring and equipment.

The use of quick-disconnect electrical plugs and sockets.

The purpose of static wicks or dischargers.

The American Wire Gage (A.W.G.) system of designating electrical wire sizes.

**Inspect, check, troubleshoot, service, and repair alternating current and direct current electrical systems.**—Level 3:

The results of short or open circuits in a generator control circuit.

The effect of sticking points in a reverse-current cutout relay.

The cause and effect of solenoid switch chatter.

The installation and circuit requirements for anticollision light systems.

The installation and circuit requirements for position lights.

The method of providing direct current for battery charging on aircraft that operate only alternating current generators.

The common methods of controlling output current and voltage of compound direct current generators.

The operating principles and characteristics of inverters.

Determine the output frequency of an alternating current generator.

The operating principles and characteristics of rectifiers.

The method of providing alternating current in aircraft that operate only direct current generators.

The electrical device usually used to convert alternating current to a lower or higher voltage without a change in frequency.

The operating principles and characteristics of electrical induction coils.

The operating principles and characteristics of transformers.

The advantages of using alternating current in aircraft.

## H. POSITION AND WARNING SYSTEMS.

**Inspect, check, and service speed- and takeoff-warning systems, electrical brake controls, and antiskid systems.**—Level 1:

The general requirements for installing skid detectors.

The operating principles of hydraulic brake antiskid systems.

**Inspect, check, troubleshoot, service, and repair landing gear position indicating and warning systems.**—Level 3:

Determine the cause of a gear unsafe warning signal.

The effect of various electrical faults in the operation of the landing gear warning system.

## I. ICE AND RAIN CONTROL SYSTEMS.

**Inspect, check, troubleshoot, service, and repair airframe ice and rain control systems.**—Level 2:

Install deicer boots.

The operating principles of anti-icing systems that utilize heated air in the leading edges of airfoils and intake ducts.

The operating principles of electrically operated anti-icing systems.

Protect deicer boots from deterioration.

## J. FIRE PROTECTION SYSTEMS.

**Inspect, check, and service smoke and carbon monoxide detection systems.**—Level 1:

The operating principles of smoke and carbon monoxide detection systems.

**Inspect, check, service, troubleshoot, and repair aircraft fire detection and extinguishing systems.**—Level 3:

The type of fire-extinguishing agent most suitable for use with electrical fires.

The fire-extinguishing agent normally used with built-in aircraft fire-extinguishing systems.

Check fire extinguisher container pressure.

Check continuity and resistance of the electrical circuit.

Determine the cause for the system failing to function.

Check fire warning sensors or detectors for open or short circuits.

# AVIATION MECHANIC POWERPLANT TEST

## Section 1. Powerplant Theory and Maintenance

### A. RECIPROCATING ENGINES.

**Inspect and repair 14-cylinder or larger radial engine.**—Level 1:

The purpose and advantages of using propeller reduction gearing.

The characteristics of thrust bearings used in large radial engines.

The characteristics of crankshaft bearings used in large radial engines.

The construction characteristics of the crankshaft and rod assemblies for a two-row radial engine.

The loads acting on the power case and nose case of a large radial engine during various conditions of operation.

The methods of classifying reciprocating engines.

The factors that affect the volumetric efficiency of an engine.

Determine the cylinder firing order for various types of engines.

**Overhaul reciprocating engine.**—Level 2:

The purpose and operating principles of dynamic dampers used in aircraft engines.

The characteristics of various crankshaft designs.

The basic operating principles of four-stroke cycle engines.

The characteristics of various piston pin and knuckle pin retention devices.

The processes used to harden cylinder bores.

The purpose and applicability of choke-type or taper-ground cylinders.

The wear characteristics of engine cylinder walls.

The purpose of valve overlap in some engines.

The effects of various poppet-type valve face angles.

The characteristics of various types of valve operating mechanisms.

The operating characteristics of zero-lash hydraulic valve lifters.

Time engine valves during engine assembly.

Install valve guides.

Grind and resurface valves and valve seats.

The purpose of using relatively large piston-to-cylinder wall clearances in aircraft engines.

The indications of failed or failing engine bearings.

The result of operating an engine at high power settings before the lubricating oil has come up to operating temperature.

Check piston rings for correct end and side clearance.

Check valve stems for stretch.

Repair a scored aluminum piston.

Perform crankshaft "runout."

Prepare engine for disassembly before overhaul.

Measure inside diameter, taper, and out-of-round of a cylinder bore.

Install cylinders and tighten holddown nuts.

The construction characteristics of air-cooled engine cylinders.

The construction characteristics and the operating principles of poppet-type engine valves.

The construction characteristics of aircraft engine pistons.

The types and arrangements of piston rings used in aircraft engines.

The purpose of using more than one spring on aircraft engine valves.

The operating principles and construction of spur and pinion-type and planetary-type propeller reduction gearing.

The principles of construction and operation of accessory gear drive trains on reciprocating engines.

Inspect cast and forged engine crankcase assemblies.

Remove and install studs in engine crankcase and accessory sections.

**Inspect, check, service, and repair opposed and radial engines and reciprocating engine installations.**—Level 3:

Check and adjust engine valve clearances. Determine the speed and direction of rotation of the cam ring in various radial engines.

The effect of excessive or insufficient valve clearance on engine operation.

The relationship between operating valve clearance and cold valve clearance.

Perform cylinder compression tests.

Perform an ignition system operational check.

Determine the condition of cable-operated engine control systems.

Check and adjust engine idling speed and mixture.

Detect and determine the cause of a "cold" cylinder.

The purpose of establishing one or more critical ranges for certain engine-propeller combinations.

The operating indications of a worn or weak engine.

The effect of a leaking oil dilution valve on engine operation.

The effect of a low oil supply on engine operation.

The indications of a correctly functioning engine oil system.

The probable cause of oil being thrown out of the breather of a wet-sump engine.

Determine the source and cause of metallic particles found on the oil screen during engine inspection.

The effect of an unbalanced propeller on engine operation.

The power settings most desirable for protracted engine operation.

Dilute engine oil in preparation for cold weather starting operations.

The purpose and operating principles of engine dynamic suspension systems.

Install and time a magneto.

**Install, troubleshoot, and remove reciprocating engines.**—Level 3:

The effect of throttle position upon fuel-air mixture in the cylinders during starting.

Pre-oil an overhauled engine before starting.

Install air-cooled engine baffles.

The method of hoisting or lifting engines during removal and installation.

The effect of increased engine manifold pressure on master rod bearing load.

The effect of air density on engine power output.

The causes of engine backfire.

The basic operational sequence for increasing or reducing the power output of an engine equipped with a constant-speed propeller.

The factors that affect an engine's tendency to detonate.

The effect of induction system air leaks on engine operation.

The indications of a leaking primer system during engine operation.

The effect of exhaust back pressure on engine power output.

The result of incorrect fuel-air mixture adjustments.

The indication and effect of carburetor icing.

Operate and adjust mechanical push-pull control systems.

## B. TURBINE ENGINES.

**Overhaul turbine engine.**—Level 2:

The relationship between rotor speed and total thrust of a turbine engine.

The relationship between turbine inlet temperature and thrust of a turbine engine.

The relationship between operating altitude and thrust of a turbine engine.

The operating characteristics of turbine engines equipped with two-spool or "split" compressors.

The operating characteristics of fan and bypass turbine engines.

The relative gas pressures in various portions of a turbine engine.

The function of the nozzle diaphragm in a turbine engine.

The function of the exhaust cone in a turbine engine.

The operating characteristics and types of combustion chambers.

Remove and install outer combustion-chamber case and liners.

The methods for disassembling compressor sections.

The function and location of fuel nozzles.

**Inspect, check, service, and repair turbine engines and turbine engine installations.**—Level 2:

The principles of operation of thrust reversing systems used with turbine engines.

The advantages of a gas turbine geared to a propeller.

The types of compressors most commonly used in turbine engines.

The construction and operating characteristics of axial-flow compressors.

The advantages of the axial-flow compressor over the centrifugal compressor.

The function and location of the diffuser section.

The basic design of turbine blades.

The effect of high ambient temperatures on turbine engine operation.

The type failures to which turbine components are subject.

The results of excessive operating temperature.

**Install, troubleshoot, and remove turbine engines.**—Level 2:

The operating principles of a turbine engine.

The effect of air density on the thrust of a turbine engine.

The effect of exhaust nozzle adjustments on turbine engine operation.

The method of controlling compressor surge.

The purpose and operation of fuel control devices.

The cause of hot spots on the outer combustion casing.

The method of insuring ignition in combustion chambers not equipped with igniter plugs.

Adjust turbine engine fuel controls.

## C. ENGINE INSPECTION.

**Perform powerplant conformity and airworthiness inspections.**—Level 3:

Determine that applicable Airworthiness Directives are complied with.

Determine that the powerplant conforms with the applicable FAA Specification.

## AVIATION MECHANIC POWERPLANT TEST

### Section 2. Powerplant Systems and Components

### A. ENGINE INSTRUMENT SYSTEMS.

**Troubleshoot, service, and repair fluid rate-of-flow indicating systems.**—Level 2:

The purpose and operating principles of a fuel-flow indicating system.

The relationship between fuel flow and the power output of an engine.

**Inspect, check, service, troubleshoot, and repair engine temperature, pressure, and r.p.m. indicating systems.**—Level 3:

The operating principles of thermocouple-type temperature indicating systems.

The effect of a broken or leaking manifold pressure gage line.

The purpose and operating principles of an exhaust gas analyzer system.

The purpose and operating principles of a manifold pressure indicating system.

The operating principles of engine oil temperature indicating systems.

Apply markings to the glass face of engine instruments.

Install tachometer drives.

Determine the reason for failure of an electric tachometer system.

The requirements for a carburetor air temperature indicating system.

Determine the reason for an off-scale reading of a ratiometer-type indicating system.

Determine the cause of erratic indications when using a thermocouple system.

The purpose and operating principles of fuel pressure warning systems.

The installation practices for thermocouple leads.

The operation and use of synchronous motors.

Measure the resistance of thermocouple leads.

Determine the cause of an inverse reading in a thermocouple temperature indicating system.

Identify the types and application of thermocouples used to indicate turbine engine temperatures.

### B. ENGINE FIRE PROTECTION SYSTEMS.

**Inspect, check, service, troubleshoot, and repair engine fire detection and extinguishing systems.**—Level 3:

Check continuity and resistance of the electrical circuit.

Determine the causes of system malfunction.

The methods used to release the extinguishing agent.

The sensing devices used in the detection systems.

### C. ENGINE ELECTRICAL SYSTEMS.

**Repair engine electrical system components.**—Level 2:

Check the condition of shunt and compound generator field circuits.

Locate and use overhaul information for electrical equipment.

The procedures for correcting generator brush arcing.

Check a motor or generator armature to determine that the windings are not grounded.

Smooth the commutator surface of a motor or generator armature.

Determine the cause of solder deposits on the armature cover plate of a generator.

The purpose of a ripple filter in a generator power circuit.

The type of electric motor used with direct-cranking engine starters.

The types of voltage regulators used with high output direct current generators.

The results of short or open circuits in a generator control circuit.

The effect of sticking points in a reverse-current cutout relay.

The method of providing and controlling the field current of aircraft generators.

The methods of controlling parallel direct current generators.

The methods used to control output frequency and voltage of alternating current generators.

The methods of reducing armature reaction in aircraft generators.

The methods of controlling current and voltage output of compound direct current generators.

The operating principles of carbon-pile voltage regulators.

The operating characteristics of series-wound direct current electric motors.

The purpose and operation of reverse-current cutout relays in generator control circuits.

The general operating characteristics of vibrator-type current and voltage regulators.

Flash a generator field.

The effect of changes in speed and load on generator output.

The design factors that determine the number of cycles per revolution an alternating current generator will produce.

The factors that affect the torque produced by an electric motor.

The function of a commutator in a direct current electic motor.

Determine the output frequency of an alternating current generator.

The methods used to protect armature shafts from overloads.

Seat new or replacement generator brushes.

The effect of incorrect generator brush spring tension on generator operation.

The speed and load characteristics of series-, compound-, and shunt-wound electric motors.

The basic principles of electric generators.

The basic internal electrical circuits of series-, compound-, and shunt-wound generators.

The applicability and use of intermittent-duty electric motors.

The operating principles of magnetic clutches and brakes commonly used with electric motors.

The requirements and methods for controlling a malfunctioning generator.

The purpose and operation of reversible electric motors.

**Install, check, and service engine electrical wiring, controls, switches, indicators, and protective devices.**—Level 3:

The purpose, applicability, and operation of electrical fuses and circuit breakers.

The types of electrical switches and their operation.

Install and wire electrical switches.

Splice wiring in engine electrical systems.

The characteristics of high-tension and low-tension electrical wiring.

The purpose, applicability, and use of electrical wiring terminal strips.

The criteria for selecting aluminum and copper electrical cables.

Replace terminals on aircraft aluminum and copper electrical cables.

Types of switches and circuits used to control reversible electric motors.

Identify aircraft electric cables.

Determine the current-carrying capacity of an electrical circuit.

Install electrical wiring in conduits.

Use electric cable selection chart for determining the correct cable to use in specified circumstances.

The strength requirements for electric cable terminals.

Select and install electrical bonding jumpers.

The installation requirements for electrical junction boxes.

The installation and wiring of solenoid-operated switches.

The characteristics of single-wire electrical systems.

The use of quick-disconnect electrical plugs and sockets.

The American Wire Gage (A.W.G) system of designating electrical wire sizes.

The cause and effect of solenoid switch chatter.

The method of providing direct current for battery charging on aircraft that operate only alternating current generators.

The maximum permissible continuous load on the electrical system.

The sources of alternating current power in aircraft that operate only direct current generators.

The operating principles and characteristics of transformers.

Determine the approximate continuous load on an aircraft electrical system.

## D. LUBRICATION SYSTEMS.

**Identify and select lubricants.**—Level 2:

The desirable characteristics for aircraft engine lubricating oils.

The meaning and importance of oil viscosity.

The meaning and significance of oil flash point.

The purpose of using synthetic lubricants for turbine engines.

The effect of heat on lubricants.

The grade designations for aviation oils.

The designations for synthetic turbine oil.

The results of operating an engine using an incorrect lubricant.

The functions of engine oil in addition to lubricating the engine.

**Repair engine lubrication system components.**—Level 2:

Clean and repair aluminum alloy external oil lines.

Clean external lubrication system components.

The function and location of an oil temperature regulator.

The size requirement for the oil inlet line.

Clean and test oil tanks.

The purpose and operation of the oil cooler.

The operating principles of lubrication pumps.

**Inspect, check, service, troubleshoot, and repair engine lubrication systems.**—Level 3:

Determine source and cause of metallic particles in the lubricating oil.

The purpose and principles of operation of engine oil dilution systems.

The expansion space requirements for engine oil supply tanks.

The purpose for changing engine lubricating oil at specified intervals.

The type of lubrication system generally used in high-volume reciprocating engines.

The factors that affect the oil consumption of a reciprocating engine.

The method normally used to prevent excessive oil from accumulating in the cylinders of inverted engines or the lower cylinders of radial engines.

The method of controlling the oil film on cylinder walls.

The method of lubricating the valve-operating mechanism in an overhead-valve engine.

The venting requirements of dry-sump and wet-sump engine lubrication systems.

The effect of broken or leaking lines in various parts of the lubrication system.

The effect of engine wear on the operation of the lubrication system.

The operating indications of a low engine oil supply.

The method of maintaining a reserve supply of oil in the engine oil supply tank for use in propeller feathering.

The requirements for marking oil tank fillers.

The purpose and operating principles of the lubrication system pressure-relief valve.

The purpose and operation of the oil cooler bypass valve.

The effect of congealed oil in the heat exchange portion of an oil radiator.

The purpose, location, and operation of anti-sludge chambers in the lubrication system of a reciprocating engine.

The purpose and operation of the bypass feature built into most engine oil filtering systems.

The operating principles of the stacked disc, edge filtration type of filter.

The characteristics and operating principles of dry-sump and wet-sump engine lubricating systems.

The purpose, location, and operation of the oil separator.

Adjust engine oil pressure.

The purpose of the restricted orifice in the oil pressure gage line.

The effect of obstructed rocker box intercylinder oil drain lines on engine operation.

The characteristics and principles of operation of a radial engine oil scavenging system.

## E. IGNITION SYSTEMS.

**Overhaul magneto and ignition harness.**—Level 2:

The construction characteristics of magneto main case housings.

The characteristics and construction materials of magneto pole shoes or coil core extensions.

The purpose and methods of ventilating aircraft magneto housings.

The materials used in the construction of magneto breaker points.

The purpose and use of "keepers" placed across the poles of a rotating magnet that has been removed from a magneto.

Check the strength of a rotating magnet installed in a magneto.

Internally time a magneto during assembly.

Determine the rotational speed of a magneto when installed on various types of engines.

The purpose and location of condensers in a magneto electrical circuit.

Determine the condition of magneto breaker points by visual indications.

Lubricate a magneto breaker cam.

The effect of cam-follower wear on pivot- and pivotless-type breaker-point assemblies.

The meaning of the term "E-Gap Angle."

The characteristics of the rotating magnets commonly used in aircraft magnetos.

Install and adjust breaker points.

The characteristics of cams used in aircraft magnetos to operate the breaker points.

The purpose of setting ignition cables in a plastic insulating material within some ignition harnesses.

Install high-tension ignition cables in a shielded ignition manifold.

The purpose and operation of impulse couplings used with aircraft magnetos.

The results of operating a magneto with a broken impulse coupling spring.

The methods used to secure ignition leads in harnesses and distributor blocks.

Measure breaker point spring tension.

**Repair engine ignition system components.**—Level 2:

The purpose and operation of magneto breaker points.

Measure the capacity of a condenser.

Check ignition coil windings for shorts or open circuits.

Locate and use data associated with ignition system components.

The effect of weak magnets on engine operation.

The effect of weak breaker point spring tension on engine operation.

Clean and inspect spark plugs and igniter plugs.

Adjust spark plug electrodes.

The precautions to observe when working with high-energy ignition systems.

Determine that a distributor is internally timed.

The effect of high resistance in an ignition lead on engine operation.

The function and characteristics of ignition harnesses.

Determine the continuity of ignition wiring.

The construction and operation of a transformer coil for low-tension ignition systems.

**Inspect, check, service, troubleshoot, and repair reciprocating and turbine engine ignition systems.**—Level 3:

The purpose of shielding aircraft engine ignition systems.

The purpose and principles of staggered ignition timing.

Install and time an ignition system distributor.

Recognize and interpret basic ignition analyzer patterns.

The purpose and operating principles of spark advance systems.

The effect of using condensers of incorrect capacity in an ignition system.

The operating principles of low-tension ignition systems.

The effect a shorted primary winding in a low-tension ignition coil has on engine operation.

Install and test magneto ignition switches.

Test an ignition harness for electrical leakage.

The purpose and principles of compensated ignition timing.

The operating periods of turbine engine ignition systems.

The results of using a spark plug of incorrect heat range in an engine.

Install and remove spark plugs.

The meaning of "reach" as applied to spark plug design.

Inspect spark plugs for damaged insulation.

The cause and effect of various types of spark plug fouling.

The purpose and operation of an ignition booster system.

The purpose and operation of an induction vibrator.

Install and time a magneto equipped with an impulse coupling.

## F. FUEL METERING SYSTEMS.

**Inspect, check, and service water injection systems.**—Level 1:

The purpose and effect of injecting water or water-alcohol during periods of high engine power output.

The means used to prevent the freezing of the water or ADI liquid.

The effect of atmospheric humidity on engine power when using water injection.

The effect of exhausting the water supply during takeoff operations utilizing water injection.

The purpose and effect of the derichment valve in the water-alcohol injection system.

The results of detonation within an engine.

The procedure to follow when detonation occurs.

The factor that determines the amount of water flow during ADI operation.

The method for preventing corrosion of lines and fittings used in ADI systems.

The purpose of the oil-pressure-operated valve in the ADI system.

**Overhaul carburetor.**—Level 2:

The fuel metering forces of a conventional float-type carburetor and a pressure-type carburetor.

The relationship between carburetor venturi size and engine displacement volume.

The fuel-air mixture requirements of an engine during idling and during high power settings.

The operation of the idling system of a float-type carburetor and a pressure-type carburetor.

The effect of a clogged main air bleed in a float-type carburetor on engine operation.

Check and adjust the float level of a float-type carburetor.

The effect of an incorrectly adjusted float level on engine operation.

The effect of a worn or grooved needle valve and seat assembly in a float-type carburetor on engine operation.

The operating principles of a back-suction-type mixture control.

The operating principles of an automatic mixture control.

The operating principles of economizer systems in float-type carburetors.

The effect of a ruptured diaphragm in a pressure-type carburetor on engine operation.

The basic function of a manual mixture control in an aircraft carburetor.

The location and operating principles of discharge nozzles used with pressure carburetors.

**Repair engine fuel metering system components.**—Level 2:

The operating principles of piston-type and single- and double-diaphragm acceleration pumps.

The operating principles of direct fuel injection systems.

The purpose and operation of a venturi.

The function of a metering jet.

The purpose of an air bleed in a carburetor.

The purpose of an economizer valve in a carburetor.

Clean carburetor parts.

Repair a leaking float.

The adjustments that may be made on a pressure-injection carburetor.

The effect of clogged impact tubes on engine operation.

The function of the synchronizer bar on fuel injection equipped engines.

The function and operation of the main and idling air bleed systems in a float-type carburetor.

**Inspect, check, service, troubleshoot, and repair reciprocating and turbine engine fuel metering systems.**—Level 3:

Adjust idling speed and mixture.

The principles of operation of an automatic fuel control unit used on a turbojet engine.

Trim turbojet engine fuel control system.

The effect of increased altitude on engine fuel-air mixture.

The relative burning rates of various fuel-air mixtures.

The fuel-air mixture requirements of a reciprocating engine at various power settings.

The operating characteristics of engines with direct cylinder fuel injection systems.

Install, remove, and adjust direct cylinder fuel injection system components.

The difference between a fuel injection system and a fuel injection carburetor.

The cause of lean mixtures in a conventional carburetor system.

The effect an inoperative vapor vent in a pressure-type carburetor has on engine operation.

The factors that affect the density of the air entering the carburetor.

## G. ENGINE FUEL SYSTEMS.

**Repair engine fuel system components.**—Level 2:

The types of engine-driven fuel pumps generally used with large reciprocating engines.

The purpose and operation of a fuel pump bypass valve.

The purpose and operation of fuel boost pumps.

**Inspect, check, service, troubleshoot, and repair engine fuel systems.**—Level 3:

The causes of fuel pressure fluctuation.

The characteristics of centrifugal-type fuel boost pumps.

The fuel system requirements for aircraft certificated in the "standard" classification.

The usual sources of aircraft fuel system contamination.

The purpose and requirements for strainers in fuel tank outlets.

Inspect aircraft fuel tank sumps and fuel strainers.

Adjust engine-driven fuel pump output pressure.

The location and operation of main fuel strainers.

The causes and effects of fuel system vapor lock.

The location and operation of fuel valves.

## H. INDUCTION SYSTEMS.

**Inspect, check, troubleshoot, service, and repair engine ice and rain control systems.**—Level 2:

The principles of alcohol injection to control induction system icing.

The effect of ice within the induction system on engine operation.

The operating principles of carburetor air heaters used to prevent or eliminate ice in an engine induction system.

The method used to prevent the entry of rain into the induction system of a reciprocating engine.

The operating principles of electrically heated inlet ducts.

The use of engine bleed air to control engine inlet icing.

The causes of carburetor and induction system icing.

**Inspect, check, service, and repair heat exchangers and superchargers.**—Level 2:

The effect of using heated air during periods of high engine power output.

The pressures present in various portions of the induction system of supercharged and unsupercharged reciprocating engines.

The principles of operation and control of turbosuperchargers.

The principles of operation and control of integral superchargers.

The purpose and operation of the induction system impeller used in some radial engines.

**Inspect, check, service, and repair carburetor air intake and induction manifolds.**—Level 3:

The position of the carburetor heat control during engine starting.

The purpose and location of the induction system screen in a reciprocating engine.

The purpose and location of the "hot spot" heater in the induction system of some reciprocating engines.

The installation and operation of a multipoint priming system on a radial engine.

The purpose, location, and servicing requirements for carburetor air filters.

The purpose and operation of ram air intake ducts on reciprocating engines.

## I. ENGINE COOLING SYSTEMS.

**Repair engine cooling system components.**—Level 2:

The attachment of cylinder head baffles.

The material used in the construction of air baffles.

Reprofile cylinder fins.

The effect of valve adjustment on the heat rejection rate of an engine.

**Inspect, check, troubleshoot, service, and repair engine cooling systems.**—Level 3:

The operating principles of the cooling system of vertically installed air-cooled helicopter engines.

The effects of excessive heat in an aircraft engine.

The purpose of fins on engine cylinders.

The effect of incorrectly installed baffles on engine operation.

The function and operation of cowl flaps.

The effect of fuel-air ratio on engine cooling.

The purpose and operation of cooling air augmenting systems.

The principles of "pressure baffling" used in cooling aircraft engines.

The precautions necessary during ground operation of aircraft engines.

## J. ENGINE EXHAUST SYSTEMS.

**Repair engine exhaust system components.**—Level 2:

The construction characteristics of exhaust augmenter tubes.

The materials used in exhaust system components.

The technique for cleaning ceramic-coated exhaust pipes.

Detect and repair cracks in stainless steel exhaust pipes.

The methods used to compensate for the unequal expansion rate of exhaust system components.

**Inspect, check, troubleshoot, service, and repair engine exhaust systems.**—Level 3:

Inspect exhaust systems that utilize an exhaust heat exchanger.

The purpose and operating principles of the turbines driven by the exhaust gases of a turbo-compound engine.

The function and location of exhaust augmenters.

The cause and effect of "frozen" ball joints in an exhaust system.

Clean and test exhaust-type heating muffs.

The methods for torquing exhaust system clamps.

The purpose and construction of exhaust gas noise suppressors.

The effect of exhaust gas leakage on system components.

The purpose and operation of engine thrust reversers.

## K. PROPELLERS.

**Inspect, check, service, and repair propeller synchronizing and ice control systems.**—Level 1:

The purpose of slinger rings on some propeller installations.

The method of preventing ice formation on propeller spinners.

The operating principles of electrical deicing systems for propellers.

The purpose of the governor step motor in the synchronizing system.

The purpose of propeller synchronizing systems.

The operating principles of synchronizing systems.

The operating principles of fluid anti-icing systems.

**Identify and select propeller lubricants.**—Level 2:

The principal requirements for propeller lubricants.

The factors to be considered in selecting an oil or grease for a particular application.

**Balance propellers.**—Level 2:

The effects of propeller unbalance on engine operation.

Detect and correct vertical and horizontal unbalance in a two-blade propeller.

Balance a two-blade propeller that uses a separate hub for mounting on the engine crankshaft.

**Repair propeller control system components.**—Level 2:

Install oil control plugs in governors.

Use manufacturer's data to repair components.

The purpose and operation of a propeller governor.

The forces acting on a governor to produce speed control.

Determine the direction of rotation for which a propeller governor is set.

**Inspect, check, service, and repair fixed-pitch, constant-speed, and feathering propellers, and propeller governing systems.**—Level 3:

The purpose and function of the parts of a propeller.

The aerodynamic forces and loads acting on a rotating propeller blade.

The operating principles of propeller controls used with turbine engines.

The meaning and significance of "static limits" as related to the installation of a fixed-pitch propeller.

The purpose of the metal tipping on a wood propeller.

Measure propeller blade angle.

The meaning of propeller blade "back" and "face."

The method of making changes in the speed and power output of an engine equipped with a constant-speed propeller.

The operation of the distributor valve assembly of a hydromatic propeller.

The normal position of a constant-speed propeller control during takeoff.

The effect on engine operation of changing propeller pitch settings before a steady oil pressure is obtained after engine starting.

The meaning and significance of "critical ranges" established for some engine-propeller combinations.

The operation of a propeller during the feathering cycle.

The operation of a propeller during the reversing cycle.

The purpose of placing a propeller in a specified position prior to stopping the engine.

The relationship between blade position, airspeed, and angle of attack of the propeller blades.

The operating principles of two-position and constant-speed counterweight propellers.

The method of lubricating the pitch-changing mechanism of a hydromatic propeller.

The method of checking a steel propeller hub or blade for cracks.

The general procedure to be followed when using the chemical etching process to inspect aluminum alloy propeller blades.

Determine whether a bent aluminum alloy propeller blade can be repaired by cold straightening.

Clean and protect aluminum propeller blades.

The procedure for treating minor nicks and scratches on aluminum propeller blades.

Determine the blade pitch stop settings on a variable-pitch propeller.

The operating forces used to make blade pitch changes on various types of variable-pitch propellers.

The location and purpose of propeller blade cuffs.

**Install, troubleshoot, and remove propellers.**—Level 3:

Perform an operational check of propeller feathering system.

Detect and correct front and rear cone bottoming of a propeller installed on a splined crankshaft.

The purpose and use of snap rings on propeller installations.

The purpose and use of propeller cones in some propeller installations.

Determine the amount of contact between a tapered crankshaft and the propeller hub.

Install and track a fixed-pitch and constant-speed propeller.

Detect and correct looseness in a cable-operated propeller control system.

The most likely indications of a damaged piston-to-dome seal in a hydromatic propeller.

The most likely cause of oil leakage around the rear cone of a hydromatic propeller.

Perform an operational check of a propeller reversing system.

The constant-speed propeller setting used when checking ignition systems.

Adjust a propeller governor so that the propeller will operate within the correct range.

The purpose and significance of preloading the pitch-changing mechanism in a hydromatic propeller.

## ORAL AND PRACTICAL TESTS

Completion of the oral and practical tests is usually the final step in becoming certificated or in adding a rating to a mechanic certificate. An oral and a practical test must be taken for each rating.

Oral and practical tests are administered by FAA Flight Standards inspectors or by FAA-designated mechanic examiners (DMEs). If an FAA inspector gives the tests, the required facility, tools, materials, and supplies must be furnished or arranged for by the applicant. The adequacy and suitability of the facilities can be determined at the time arrangements for the tests are being made.

If a DME gives the tests, he will furnish the facility and can usually arrange to furnish the tools, materials and supplies needed. DMEs are not paid by the FAA for their services or the use of their facilities and equipment during the examination of mechanic applicants and are authorized to charge a fee for administering oral and practical tests. The names and addresses of the FAA-designated mechanic examiners in each district can be obtained from the FAA Flight Standards district office that serves the area or from Advisory Circular No. 183-30, Directory of FAA Designated Mechanic Examiners.

The person administering the oral and practical tests will provide an application form and give detailed instructions on how it should be filled out. He will explain each of the projects to be assigned during the practical test and give some indication of the level of performance expected.

The oral test may be administered along with the practical test in the form of questions about the projects being performed, or it may be administered separately, before or after the practical test. The examiner will not attempt to trick or mislead you in any way with his oral questions or project assignments. Any assignment or question that you do not understand should be clarified before continuing with the test.

### The Oral Test

Oral test questions cover the same subjects as the written tests and are intended to show how well the applicant can make use of his knowledge. Oral test questions fall generally into three types: (a) questions closely related to assigned practical projects—to further explore the applicant's understanding of the tasks being performed, (b) questions not related to a specific project—to evaluate the applicant's ability in areas in which a skill demonstration is not practical, and (c) questions to determine whether additional projects need to be assigned.

### Sample Oral Test Questions

Some examples of the type of questions asked during the oral test are:

1. How would you determine the leveling means for a specific aircraft?
2. What is a blind rivet and how is it used?
3. What is reinforcing tape and how is it used?
4. What is the difference between welding and brazing?
5. What is a circuit breaker and how does it work?
6. What are two causes of vapor lock in a fuel line?
7. What is the purpose of a pump-unloading valve in a hydraulic system?
8. What cylinder should be removed last during disassembly of a radial aircraft engine?
9. What is detonation and how is it harmful?
10. How would you check a magneto for correct internal timing?

11. What is the purpose of an engine oil-dilution system?
12. How would you check a propeller for correct track?
13. How is the moment of an item of equipment determined in computing aircraft weight and balance?
14. What precautions are required when fueling an aircraft?
15. What are the procedures for correcting generator brush arcing?
16. What is the most common method for determining the state of charge of a lead-acid battery?
17. How would you determine the effect that the installation of a new item of equipment has on the balance of an aircraft?
18. What is the purpose of a fuel tank sump and how is it inspected?
19. How would you determine the direction of rotation of a direct current motor?
20. Why is a reverse-current cutout relay required in a generator circuit?
21. What type compressor is most commonly used in aircraft turbine engines?
22. What are the installation practices for thermocouple leads?
23. What is the purpose and operation of the air/oil cooler in an engine lubrication system?
24. Explain the four-stroke, five-event cycle of a reciprocating engine.
25. What is the purpose of the turbine section in a jet engine?
26. What is an Airworthiness Directive?
27. What is the difference between a two-position propeller and a constant-speed propeller?
28. What are the general characteristics of the wood commonly used in aircraft construction?
29. How is stability about the horizontal axis of an aircraft obtained?

### The Practical Test

The practical test consists of assigned work projects to test mechanical skill and ability to organize work, select and follow correct procedures, apply appropriate techniques, and determine an acceptable level of workmanship. The person administering the test will select projects that utilize as much as possible equipment and procedures that are familiar to the applicant.

A high level of manipulative skill in performing complex operations is not expected. Some of the basic skills must have been developed, however, and must be demonstrated during the practical test.

Applicant's performance on projects in areas described as Level 3 in the section entitled "The Written Tests" will be expected to meet a return-to-service standard. If a project must be performed in accordance with a manufacturer's instruction or other data, the examiner will expect you to consult the instruction or data.

Any of the operations required to complete the actions in Level 2 and Level 3 action lines are potential practical projects. Notice, for instance, the entry under "E. Welding" of the Airframe Structures section of the listing. This entry is entitled "Solder, braze, gas- and arc-weld steel.—Level 2." Since this is a Level 2 action line, the applicant may be asked to perform basic welding operations, but he will not be required to be a highly skilled welder to pass the practical test.

On the other hand, consider the entry under "E. Materials and Processes" of the General section of the listing. The action line, "Inspect and check welds.—Level 3," indicates that the practical test may include a project that requires the applicant to inspect and make a dependable judgment about the quality of a welded joint. His judgment should be based upon (a) a generalized knowledge of welding materials, (b) a specific knowledge of the type of welded joint being inspected, and (c) the ability to find out all the things he needs to know about the weld in order to judge its quality.

### Sample Practical Test Projects

The following are typical of the projects assigned during mechanic practical tests.

1. Safety a turnbuckle.
2. Make a sheet metal splice.
3. Inspect a wood structure.

4. Remove, clean, inspect, and reinstall a brake master cylinder.
5. Gas-weld a steel tube.
6. Attach an electrical cable terminal.
7. Make up a section of fuel line and install fittings.
8. Bleed and adjust hydraulic brakes.
9. Compute empty weight center of gravity and the most forward and rearward loaded center of gravity of an aircraft.
10. Time the valves of an engine.
11. Adjust a carburetor float level.
12. Remove, clean, inspect, and reinstall an engine oil filter.
13. Install and time magnetos.
14. Remove and install a propeller.
15. Execute FAA Form 337, Major Repair and Alteration.
16. Perform a gear retraction test on an aircraft.
17. Replace shakeproof cowling fasteners.
18. Perform a fabric strength test.
19. Flash a direct current generator field.
20. Adjust turbine engine fuel controls.
21. Install packing seals and rings on hydraulic components.
22. Remove and install engine-driven hydraulic pumps.
23. Check an oxygen system for leaks.
24. Remove, clean, inspect, and install a fuel strainer.
25. Connect batteries to a constant-current battery charger.
26. Locate cracks in welded assemblies using dye penetrant.
27. Start an engine, and check for proper operation.
28. Adjust idle r.p.m. and mixture on a conventional carburetor.
29. Install engine cylinders and torque the holddown nuts.
30. Perform a cylinder compression test.

Oral and practical tests are graded as soon as they are completed, and the applicant is informed of his grade. If any part of either test is failed, the person administering the tests will issue a notice of disapproval of the application showing the titles of oral and practical subjects failed. He will also return the Airman Written Test Report that was presented by the applicant as evidence of having passed the written test.

An applicant who fails a test may apply for a retest as prescribed in FAR Part 65. An applicant has the option of returning to the same FAA office or DME or applying to any other office or DME for the retest. The retest will include only the subjects failed.

When all parts of the tests have been passed, the FAA office or DME will issue a temporary mechanic certificate. The following excerpts from FAR Part 65 pertain to temporary certificates.

**"§ 65.13 Temporary certificate.**

A certificate and ratings effective for a period of not more than 90 days may be issued to a qualified applicant, pending review of his application and supplementary documents and the issue of the certificate and ratings for which he applied."

Permanent certificates are prepared and issued by the Airman Certification Branch of the Federal Aviation Administration and mailed to the address indicated by the applicant when he prepares the application form.

## SAMPLE WRITTEN TEST QUESTIONS

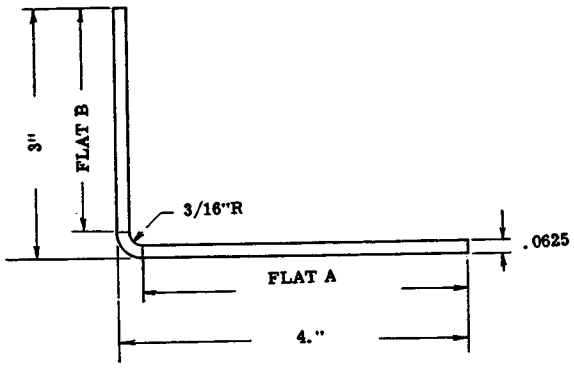
The questions in this section are similar to those contained in FAA written tests for mechanics. They are included to show the type of questions used. No attempt has been made to cover any particular subjects.

1. What must a certificated mechanic with both airframe and powerplant ratings do prior to returning to service an aircraft on which he has performed and approved a 100-hour inspection?
   1. Make the proper entries in the appropriate logbooks.
   2. Present his work and records to a mechanic holding an Inspection Authorization for final approval and release.
   3. Complete the required copies of FAA Form 337 including an accurate description of the work performed, date, mechanic's name, and certificate number.
   4. Notify the local FAA maintenance inspector in writing of his intention to return the aircraft to service.

2. After making a major structural repair to an aircraft that is to be returned to service, FAA Form 337, Major Repair and Alteration, must be prepared. How many copies are required and what is the final disposition of the completed forms?
   1. Three—one copy for the aircraft owner and two copies for the FAA.
   2. Two—one copy for the aircraft owner and one copy for the FAA.
   3. Three—one copy for the aircraft owner, one copy for the FAA, and one copy for the permanent records of the repairing agency or individual.
   4. Two—both copies for the FAA.

3. If the container volume of a confined gas is doubled (assume temperature remains constant), the pressure will
   1. increase in direct proportion to the volume increase.
   2. remain the same.
   3. be doubled.
   4. be reduced to one-half its original value.

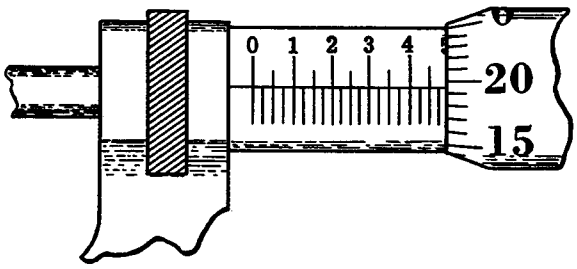
4. How many AN470AD-4-6 rivets will be required to attach a 10″ x 5″ splice plate if single-row, minimum edge distance, 4D spacing is used?
   1. 60 rivets.
   2. 56 rivets.
   3. 62 rivets.
   4. 52 rivets.




5. The length of flat A in the above drawing is
   1. 3.750 inches.
   2. 3.875 inches.
   3. 3.813 inches.
   4. 3.937 inches.

6. When making a forward weight and balance check to determine that the center of gravity (c.g.) will not exceed the forward limit during extreme conditions, the items of useful load which should be computed at their minimum weights are those located aft of the

1. forward c.g. limit
2. rearward c.g. limit.
3. datum.
4. empty weight c.g.




7. The micrometer scale shown above indicates a measurement of
   1. 0.5195 inch.
   2. 0.4945 inch.
   3. 0.4695 inch.
   4. 0.4819 inch.

8. As the velocity of the air across an aircraft wing increases, the pressure of the air on the upper surface
   1. increases.
   2. decreases.
   3. drops to zero.
   4. remains unchanged.

9. If the cross-sectional area of a given conductor is increased to four times its original value and the length and temperature remain constant, the resistance of the conductor will be
   1. one-fourth its original value.
   2. four-times its original value.
   3. the same as its original value.
   4. found by multiplying the original resistance by the percentage increase in cross-sectional area.

10. Which of the following sequences of connecting and tightening the battery leads should result in the safest procedure for installation of a battery in an aircraft with a single-wire, ground-return electrical system?
   1. Connect and tighten the negative (ground) lead before connecting the positive lead.
   2. Connect the negative (ground) lead, connect the positive lead, then tighten in the same order.
   3. Connect the positive lead, connect the negative (ground) lead, then tighten in the same order.
   4. Connect and tighten the positive lead before connecting the negative (ground) lead.

11. Which of the following statements relating to the conduct of a 100-hour inspection is true?
   1. The inspecting agency shall use an inspection form as a checklist while performing a 100-hour inspection.
   2. The inspecting agency is not required to use an inspection form as a checklist while performing a 100-hour inspection.
   3. The inspecting agency shall use only the inspection form furnished and prescribed by the FAA Administrator as a checklist while performing a 100-hour inspection.
   4. The inspecting agency shall use only the inspection form furnished and prescribed by the manufacturer as a checklist while performing a 100-hour inspection.

12. Which of the following has little or no effect upon the rate of vaporization of a given fuel?
   1. The pressure of the surrounding air.
   2. The temperature of the fuel.
   3. The temperature of the surrounding air.
   4. The antiknock value of the fuel.

13. If an aircraft is cruising in level flight and the stick or control column is moved forward, the elevator will
   1. go down and the nose of the aircraft will go down.
   2. go up and the nose of the aircraft will go down.
   3. go down and the nose of the aircraft will go up.
   4. go up and the nose of the aircraft will go up.

14. During the inspection of an aircraft equipped with a push-pull tube-type control system, the threaded rod ends should
   1. be checked for the amount of thread engagement by means of the inspection hole provided.

2. be checked to determine that the ball-bearing end is properly safetied to the push-pull rod with brass or stainless steel safety wire.
3. be lubricated with waterproof high-pressure grease.
4. not be adjusted in length for rigging purposes because the rod ends have been properly positioned and staked during manufacture

15. How should loosely adhering dust and dirt be removed from the exterior surfaces of aircraft transparent plastics?
1. Spray the surface with any commercial window cleaner.
2. Wipe the surface with a moist chamois.
3. Flush the surface with water.
4. Wipe the surface with a dry cloth.

16. When rigging the wings on a monoplane equipped with front and rear lift struts, the general practice is to
1. control dihedral angle by the length of the front struts.
2. establish the incidence angle by the length of the front struts, and wash-in and wash-out by adjusting the length of the rear struts.
3. pre-rig the rear struts and adjust the length of front struts for propeller-torque correction as required.
4. use struts of fixed length and rig in propeller-torque correction by the use of ground-adjustable rudder tabs.

17. It is not considered good aircraft finishing technique to
1. spray enamels over dopes or lacquers.
2. spray bituminous paint on wood.
3. spray dope or lacquer over unbaked enamels.
4. use zinc chromate primer on aluminum-alloy structures.

18. A lapped and doped spanwise seam at the trailing edge of a wing should be covered with surface tape at least 3 inches wide. Prior to application, the surface tape should be notched at intervals not to exceed 6 inches to
1. make it easier to put on severe curvatures.
2. prevent the entire tape from loosening in the event the tape begins to separate.
3. increase the length of the tape's edges for better doping.
4. prevent raveling of the tape.

19. Repairs or splices involving stringers on the lower surface of stressed-skin metal wings are usually
1. not permitted.
2. permitted but are normally more critical in reference to strength than similar repairs to the stringers on the upper surface.
3. permitted but are normally more critical in reference to aerodynamic cleanness than similar repairs to the upper surface.
4. permitted only if the damage does not exceed 6 inches in any direction.

20. Which of the following is *not* indicated by the aluminum sheet designation ALCLAD 2024–T36?
1. The process or combination of operations used to produce the stable temper.
2. The thickness of the sheet.
3. Major alloying element.
4. Method used to produce stable temper (whether strain hardened or heat treated).

21. When steel hi-shear rivets are used to assemble aluminum alloy structural components, they should be
1. used at no greater ratio than one hi-shear rivet for each three aluminum alloy rivets.
2. driven at 830° to 860° F. in order to reduce the possibility of cracking.
3. coated with zinc chromate primer prior to assembly to reduce dissimilar-metal corrosion.
4. fitted to extremely close tolerances.

22. The type of fluid to be used in an aircraft hydraulic system can be determined
1. only by a chemical analysis of a sample of fluid from the system.
2. by the markings on or near the reservoir filler opening.
3. by the color code attached to the hydraulic lines.

4. by mixing a sample of the fluid to be added with a sample of the fluid in the system and observing the reaction.

23. What will cause an engine-driven hydraulic pump of the correct capacity to fail to maintain normal system pressure during the operation of a cowl flap actuating unit?

1. Severe bends in the cowl flap actuating cylinder lines.
2. Severe restriction in the pump outlet.
3. A partial restriction in the in-port of the selector valve.
4. A partial restriction in the out-port of the selector valve.

24. Many landing gear systems use sequence valves to cause one hydraulic operation to follow another in a definite order. These valves are classified as

1. pressure control valves.
2. flow control valves.
3. timelag valves.
4. automatic crossflow valves.

25. Shuttle valves installed in large aircraft braking systems allow

1. two independent systems to operate the same actuator if necessary.
2. the safe application of brakes regardless of ground speed due to the compensating action of the valves.
3. fluid to bypass from the right wheel cylinder to the left wheel cylinder if braking pressures are different.
4. the compensating port, interconnecting both master cylinders, to discharge fluid alternately from one to the other.

26. Cabin pressurization differential pressure is normally controlled by

1. varying the outflow valve position with changes of engine r.p.m. at constant altitude.
2. maintaining cabin supercharger speed at a fixed rate regardless of altitude by a constant-speed drive.
3. constant-volume cabin superchargers and an automatically positioned cabin outflow valve.
4. manually regulating the setting of the butterfly valve located between the supercharger and the cabin.

27. The wing leading edges of transport category turbojet airplanes are generally protected from ice accumulation by

1. hot air bleed from the engine compressor section to the leading edge.
2. hot air from combustion heaters which are located in each wing.
3. electrically heated synthetic rubber boots over the leading edge.
4. pneumatically operated expansion boots on the leading edge.

28. Aircraft equipped with a d.c. electrical system often require a source of a.c. to operate communication or navigation equipment. What electrical device is used to convert d.c. to a.c.?

1. A rectifier.
2. An inverter.
3. An exciter.
4. A capacitor.

29. Which of the following methods will be effective in reversing the direction of rotation of a d.c. electric motor?

1. Reverse the direction of current flow through either the field or the armature.
2. Reverse the direction of current flow through the motor.
3. Rotate the brush assembly approximately 90 degrees.
4. Move the starting winding 180 degrees from its present position.

30. Which of the following is *not* a recommended aircraft electric cable practice?

1. All cables to single items of equipment should be grouped separately.
2. Insulating tubing should be installed over terminals and disconnect splices.
3. All splices in adjacent parallel conductors should be staggered.
4. Alternating current cables should be grouped with direct current cables.

31. What effect will increased humidity have on engine power output?

1. No appreciable change in power output.
2. Power output will decrease at all altitudes.
3. Power output will increase at all altitudes.
4. No effect at sea level but greater power output at altitude.

32. Where in the airstream is the induction system screen located in a reciprocating engine?

1. After the carburetor.
2. Before the carburetor if the engine is equipped with a downdraft carburetor and after the carburetor if the engine is equipped with an updraft carburetor.
3. Before the carburetor.
4. Before the carburetor if the engine is equipped with an updraft carburetor and after the carburetor if the engine is equipped with a downdraft carburetor.

33. What method is ordinarily used to make idle speed adjustments on a float-type carburetor?

1. An adjustable throttle stop or linkage.
2. A variable restriction in the drilled passageway which connects the air space of the float chamber and the carburetor venturi.
3. An orifice and adjustable tapered needle.
4. A variable restriction in the idle system fuel supply.

34. The use of water injection permits a reciprocating engine to be operated at high power output by

1. enriching the mixture.
2. suppressing detonation.
3. cooling the fuel-air charge as it passes through the intake manifold.
4. increasing the octane rating of the fuel.

35. Which of the following is *not* a factor in the operation of an automatic fuel control unit used on a turbojet engine?

1. Mixture control position.
2. Compressor inlet air density.
3. Compressor r.p.m.
4. Throttle position.

36. When does ignition occur in a four-stroke cycle engine?

1. Before the piston reaches top center on the compression stroke.
2. At top center of the compression stroke.
3. At the beginning of the power stroke.
4. After the piston begins its downward travel on the power stroke.

37. Burned or electrically distorted magneto breaker point contact surfaces usually indicate

1. primary circuit condenser not functioning properly.
2. use of improper fuel.
3. poor point lubrication.
4. shorted spark plug leads.

38. To what does the term "spark plug reach" refer?

1. The length of the threaded portion of the shell.
2. The amount of center electrode exposed to the heat of combustion.
3. The heat range within which the spark plug is designed to operate.
4. The amount of insulator exposed to the heat of combustion.

39. An impulse coupling gives a momentary high spin to the magneto rotor and

1. retards the spark a predetermined amount during the starting process.
2. disengages the trailing electrode.
3. feeds battery current into the primary circuit of the magneto.
4. momentarily shorts out the primary condenser; thus, assists in giving a very "hot" spark for starting.

40. What is the number of crankshaft revolutions required to cause the five-lobe cam plate of a nine-cylinder radial engine to turn one complete revolution?

1. 2.
2. 5.
3. 10.
4. 4½.

41. If an engine equipped with a constant-speed propeller is operated at part throttle and at cruising r.p.m., a reduction in r.p.m. with no change in throttle setting will result in

1. no change in manifold pressure.
2. an increase in manifold pressure.
3. a decrease in bmep.
4. a decrease in manifold pressure.

42. Thermocouple-type temperature indicating instrument systems

1. require no external power source.
2. are classed as balanced type, variable resistor circuits.
3. usually contain a balancing circuit in the instrument case to prevent fluctu-

ations of the aircraft electrical system voltage from affecting the temperature reading.

4. will not indicate a true reading if the aircraft electrical system voltage varies beyond the range for which the instruments are calibrated.

43. Which of the following is correct in reference to installation of aluminum alloy baffle brackets under cylinder holddown nuts?

1. The practice is not recommended.
2. It is considered good practice because the soft aluminum will allow the nut to align perfectly with the cylinder flange surface.
3. It is not recommended unless all contact surfaces are properly treated to eliminate the possibility of dissimilar-metal corrosion.
4. It is considered good practice unless the added thickness of the bracket does not allow the nut slot to line up with the cotter pin hole within the range of recommended torque values.

44. What should be done before adjusting (to the "cold" clearance setting) the valve clearance of a nine-cylinder radial engine equipped with a four-lobe, double-track cam ring?

1. Remove and visually inspect all cam follower assemblies.
2. Open all valve clearances to the "hot" or "timing" setting.
3. Determine the least worn cam flat on each track.
4. Open all valve clearances to approximately twice the required setting.

45. The purpose of the bypass valve on an oil cooler is to bypass the

1. hot oil into the hopper tank directly.
2. cold oil into the oil filter.
3. hot oil past the "Y" drain.
4. cold oil into the hopper tank directly.

46. Which of the following is referred to as the propeller blade face?

1. The root end of a propeller blade.
2. The flat side of a propeller blade.
3. The cambered side of a propeller blade.
4. The cuff around a propeller blade.

47. Hydraulically operated propellers, that are in the low r.p.m. position for starting, should not be changed to the high r.p.m. setting until a steady oil pressure is obtained. This procedure is followed to prevent

1. congealing of the oil in the nose case scavenger system.
2. erratic pitch change during later propeller operation.
3. oil starvation of the highly stressed engine bearings.
4. the possibility of an air lock forming in the propeller governor boost pump.

48. What is the primary purpose of propeller cones, as used with propellers that are installed on engines with splined shafts?

1. To prevent contact between the shaft splines and the propeller hub splines.
2. To prevent rotation of the propeller on the shaft.
3. To reduce acceleration loads on the shaft splines.
4. To center the propeller on the shaft.

49. If a constant-speed propeller control is set in the constant-speed range and the engine is being operated at cruising power,

1. retarding the throttle will result in an increase in blade pitch.
2. movement of the throttle will have no effect on blade pitch.
3. the r.p.m will vary directly with movement of the throttle.
4. advancing the throttle will result in an increase in blade pitch.

50. Why is a double-field winding (split field) used in some d.c. electric motors?

1. To allow the motor to operate in either direction (reversible motor).
2. One set of field windings is used as a magnetizing coil to actuate the armature brake.
3. One set of field windings is used as a magnetizing coil to engage the motor clutch.
4. One set of field windings is used as a magnetizing coil to disengage the motor clutch.

## Answers to Sample Written Test Questions

| *Question Number* | *Answer* | *Question Number* | *Answer* | *Question Number* | *Answer* |
|---|---|---|---|---|---|
| 1 | 1 | 18 | 2 | 35 | 1 |
| 2 | 2 | 19 | 2 | 36 | 1 |
| 3 | 4 | 20 | 2 | 37 | 1 |
| 4 | 2 | 21 | 4 | 38 | 1 |
| 5 | 1 | 22 | 2 | 39 | 1 |
| 6 | 1 | 23 | 2 | 40 | 3 |
| 7 | 2 | 24 | 2 | 41 | 2 |
| 8 | 2 | 25 | 1 | 42 | 1 |
| 9 | 1 | 26 | 3 | 43 | 1 |
| 10 | 4 | 27 | 1 | 44 | 3 |
| 11 | 1 | 28 | 2 | 45 | 4 |
| 12 | 4 | 29 | 1 | 46 | 2 |
| 13 | 1 | 30 | 4 | 47 | 3 |
| 14 | 1 | 31 | 2 | 48 | 4 |
| 15 | 3 | 32 | 3 | 49 | 4 |
| 16 | 1 | 33 | 1 | 50 | 1 |
| 17 | 3 | 34 | 2 | | |

## RECOMMENDED STUDY MATERIALS

The publications listed in this section will be helpful to persons studying for airframe and powerplant tests. However, they cannot be depended upon to provide the total technical information required for either rating. It is the responsibility of each applicant to obtain study material appropriate to his own needs.

A variety of excellent text and reference material is available from commercial publishers. Most public and institutional libraries maintain technical reference sections and can often recommend specific textbooks and authors. Manufacturers' operation, maintenance, and instructional manuals are also a good source of technical material.

Publications identified as (GPO) in this section are available from the:

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402,

or from GPO bookstores located in major cities throughout the United States.

Publications identified as "(Free FAA)" in this section are available from:

U.S. Department of Transportation
Publications Section, TAD-443.1
Washington, D.C. 20590

**Federal Aviation Regulations (FAR)**—The following regulations should be useful to a person studying for mechanic tests. A knowledge of the rules they contain is often helpful and sometimes necessary during the performance of mechanic privileges. FARs contain direct references for answering present written test questions. The appendix contains complete titles and ordering instructions for FARs.

| FAR PART | TITLE |
|---|---|
| 1 | Definitions and Abbreviations |
| 21 | Certification Procedures for Products and Parts |
| 23 | Airworthiness Standards: Normal, Utility, and Acrobatic Category Airplanes |
| 25 | Airworthiness Standards: Transport Category Airplanes |
| 27 | Airworthiness Standards: Normal Category Rotorcraft |
| 29 | Airworthiness Standards: Transport Category Rotorcraft |
| 33 | Airworthiness Standards: Aircraft Engines |
| 35 | Airworthiness Standards: Propellers |
| 37 | Technical Standard Order Authorizations |
| 39 | Airworthiness Directives |
| 43 | Maintenance, Preventive Maintenance, Rebuilding, and Alteration |
| 45 | Identification and Registration Marking |
| 65 | Certification: Airmen Other Than Flight Crewmembers |
| 91 | General Operating and Flight Rules |
| 121 | Certification and Operations: Domestic, Flag, and Supplemental Air Carriers and Commercial Operators of Large Aircraft |

**FAA Advisory Circulars**—The FAA issues advisory circulars to inform the aviation public in a systematic way of nonregulatory material of interest. Advisory circulars are issued in a numbered-subject system corre-

sponding to the numbering system used for Federal Aviation Regulations.

The advisory circulars most often used for general study purposes are:

**AC 00-2 [latest revision] Advisory Circular Checklist.** Provides a list of current FAA advisory circulars. (Free FAA)

**AC 25-5C Plane Sense.** Provides general aviation information for the private aircraft owner. (Free FAA)

**AC 20-9 Personal Aircraft Inspection Handbook.** Provides a general guide, in simple nontechnical language, for the inspection of aircraft. (GPO)

**AC 20-23D Interchange of Service Experience—Mechanical Difficulties.** Advises of the malfunction and defect program and its relationship to the General Aviation Inspection Aids. (Free FAA)

**AC 20-43A Aircraft Fuel Contamination.** Informs the aviation community of the potential hazards of fuel contamination, its control, and recommended fuel servicing procedures. (Free FAA)

**AC 43.13-1A Acceptable Methods, Techniques, and Practices—Aircraft Inspection and Repair.** Contains methods, techniques, and practices acceptable to the Administrator for inspection and repair to civil aircraft. (GPO)

**AC 43.13-2 Acceptable Methods, Techniques, and Practices—Aircraft Alterations.** Contains methods, techniques, and practices acceptable to the Administrator in altering civil aircraft. (GPO)

**AC 65-9 Airframe & Powerplant Mechanics—General Handbook.** This handbook may be used for training mechanics or for on-the-job training in basic information on electricity, weight and balance, physics, mathematics, mechanic privileges and limitations, etc. (GPO)

**AC 65-12 Airframe & Powerplant Mechanics—Powerplant Handbook.** This handbook may be used for training mechanics or for on-the-job training in the construction, theory of operation, and maintenance of aircraft powerplants. (GPO)

**AC 65-15 Airframe & Powerplant Mechanics — Airframe Handbook.** This handbook may be used for training mechanics or for on-the-job training in airframe construction, repair, and the operating theory of airframe systems. (GPO)

Many other advisory circulars may be useful to a mechanic or mechanic applicant. The Advisory Circular Checklist should be consulted for titles, descriptions, and ordering information. A partial list of related circulars is shown below:

**AC 20-7 [latest revision] General Aviation Inspection Aids Summary.** Contains information on reported service difficulties of various aircraft during the year. (Sub. GPO)

**AC 20-30A Airplane Position Lights and Supplementary Lights.** Provides an acceptable means for complying with the position light requirements for airplane airworthiness and acceptable criteria for the installation of supplementary lights on airplanes. (Free FAA)

**AC 20-32B Carbon Monoxide (CO) Contamination in Aircraft—Detection and Prevention.** Informs aircraft owners, operators, maintenance personnel, and pilots of the potential dangers of carbon monoxide contamination and discusses means of detection and procedures to follow when contamination is suspected. (Free FAA)

**AC 20-35B Tie-down Sense.** Provides information of general use on aircraft tie-down techniques and procedures. (Free FAA)

**AC 20-36D Index of Materials, Parts and Appliances Certified Under the Technical Standard Order System—July 1, 1972.** Lists the materials, parts, and appliances for which the Administrator has received statements of conformance under the Technical Standard

Order system. Such products are deemed to have met the requirements for FAA approval as provided in Part 37 of the Federal Aviation Regulations. (Free FAA)

**AC 20-44 Glass Fiber Fabric for Aircraft Covering.** Provides a means, but not the sole means, for acceptance of glass fiber fabric for external covering of aircraft structures. (Free FAA)

**AC 20-45 Safetying of Turnbuckles on Civil Aircraft.** Provides information on turnbuckle safetying methods that have been found acceptable by FAA during past aircraft type certification programs. (Free FAA)

**Miscellaneous FAA Publications**—Information contained in the following publications are often needed by a certificated mechanic during the exercise of certain privileges. Mechanic applicants should know what type of information they contain, but may find it inadvisable to purchase them for study purposes only.

**Specifications**—The Aircraft, Engine, and Propeller Specifications are available from the Government Printing Office. The basic subscription consists of Specifications and Type Data Sheets, listings and indexes, plus monthly supplementary service for approximately one year.

Aircraft Type Certificate Data Sheets and Specifications. (Sub. GPO)

Aircraft Engine and Propeller Type Certificate Data Sheets and Specifications. (Sub. GPO)

**Airworthiness Directives**—The airworthiness directives are summarized in two volumes, one covering small aircraft and the other large aircraft. Each volume may be purchased separately.

The January 1976 issues of the Summary of Airworthiness Directives—Volumes I and II, will be sold and distributed for the Superintendent of Documents by the Federal Aviation Administration from Oklahoma City, Oklahoma. Requests for subscriptions to either of these publications should be sent to:

U.S. Department of Transportation
Federal Aviation Administration
P.O. Box 25461, Attn: AAC-23
Oklahoma City, OK 73125

Subscription service will consist of the summary and automatic biweekly updates to each summary for a 2-year period. Make certified checks or money orders payable to the Federal Aviation Administration.

**Summary of Airworthiness Directives for Small Aircraft (1-1-76) Volume I.** Presents, in volume form, all the Airworthiness Directives for small aircraft issued through December 31, 1975. AD's for engines, propellers, and equipment are included in each volume. Each volume is arranged alphabetically by product manufacturer. (Sub. GPO)

**Summary of Airworthiness Directives for Large Aircraft (1-1-76) Volume II.** Presents, in volume form, all the Airworthiness Directives for large aircraft (over 12,500 pounds maximum certificated takeoff weight) issued through December 31, 1975. AD's for engines, propellers, and equipment are included in each volume. (Sub. GPO)

# APPENDIX

## FEDERAL AVIATION REGULATIONS

The FAA publishes the Federal Aviation Regulations to make readily available to the aviation community the regulatory requirements placed upon them. These Regulations are sold as individual Parts by the Superintendent of Documents.

The more frequently amended Parts are sold on subscription service (that is, subscribers will receive Changes automatically as issued), while the less active Parts are sold on a single-sale basis. Changes to single-sale Parts will be sold separately as issued. Information concerning these Changes will be furnished by FAA through its "Status of the Federal Aviation Regulations, AC 00-44." Instructions for ordering this free status list are given in the front of each single-sale Part.

The following list indicates the breakdown of the single-sale Parts and the subscription Parts. Check or money order made payable to the Superintendent of Documents should be included with each order. Submit orders for single-sales and subscription Parts on different order forms. No COD orders are accepted. All FAR Parts should be ordered from: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

PARTS SOLD ON SUBSCRIPTION SERVICE

| Part | Title | Catalog number | Publication date |
|---|---|---|---|
| 1 | Definitions and abbreviations | TD 4.6:1 | June 1974 |
| 21 | Certification procedures for products and parts | TD 4.6:21 | May 1974 |
| 23 | Airworthiness standards: Normal, utility, and acrobatic category airplanes | TD 4.6:23 | June 1974 |
| 25 | Airworthiness standards: Transport category airplanes | TD 4.6:25 | do |
| 33 | Airworthiness standards: Aircraft engines | TD 4.6:33 | August 1974 |
| 36 | Noise standards: Aircraft type certification | TD 4.6:36 | June 1974 |
| 37 | Technical standard order authorizations | TD 4.6:37 | May 1974 |
| 43 | Maintenance, preventive maintenance rebuilding, and alteration | TD 4.6:43 | January 1974 |
| 47 | Aircraft registration | TD 4.6:47 | May 1974 |
| 61 | Certification: Pilots and flight instructors | TD 4.6:61 | November 1974 |
| 63 | Certification: Flight crewmembers other than pilots | TD 4.6:63 | Sept. 1974 |
| 65 | Certification: Airmen other than flight crewmembers | TD 4.6:65 | do |
| 91 | General operating and flight rules | TD 4.6:91 | March 1974 |
| 93 | Special air traffic rules and airport traffic patterns | TD 4.6:93 | do |
| 103 | Transportation of dangerous articles and magnetized materials | TD 4.6:103 | do |
| 105 | Parachute jumping | TD 4.6:105 | do |
| 121 | Certification and Operations: Domestic, flag, and supplemental air carriers and commercial operators of large aircraft | TD 4.6:121 | April 1974 |
| 123 | Certification and operations: Air travel clubs using large airplanes | TD 4.6:123 | do |
| 127 | Certification and operations of scheduled air carriers with helicopters | TD 4.6:127 | do |
| 133 | Rotorcraft external-load operations | TD 4.6:133 | November 1974 |
| 135 | Air taxi operators and commercial operators of small aircraft | TD 4.6:135 | do |
| 139 | Certification and operations: Land airports serving CAB-certificated scheduled air carriers operating large aircraft (other than helicopters) | TD 4.6:139 | December 1974 |
| 141 | Pilot schools | TD 4.6:141 | November 1974 |
| 152 | Airport aid program | TD 4.6:152 | December 1974 |

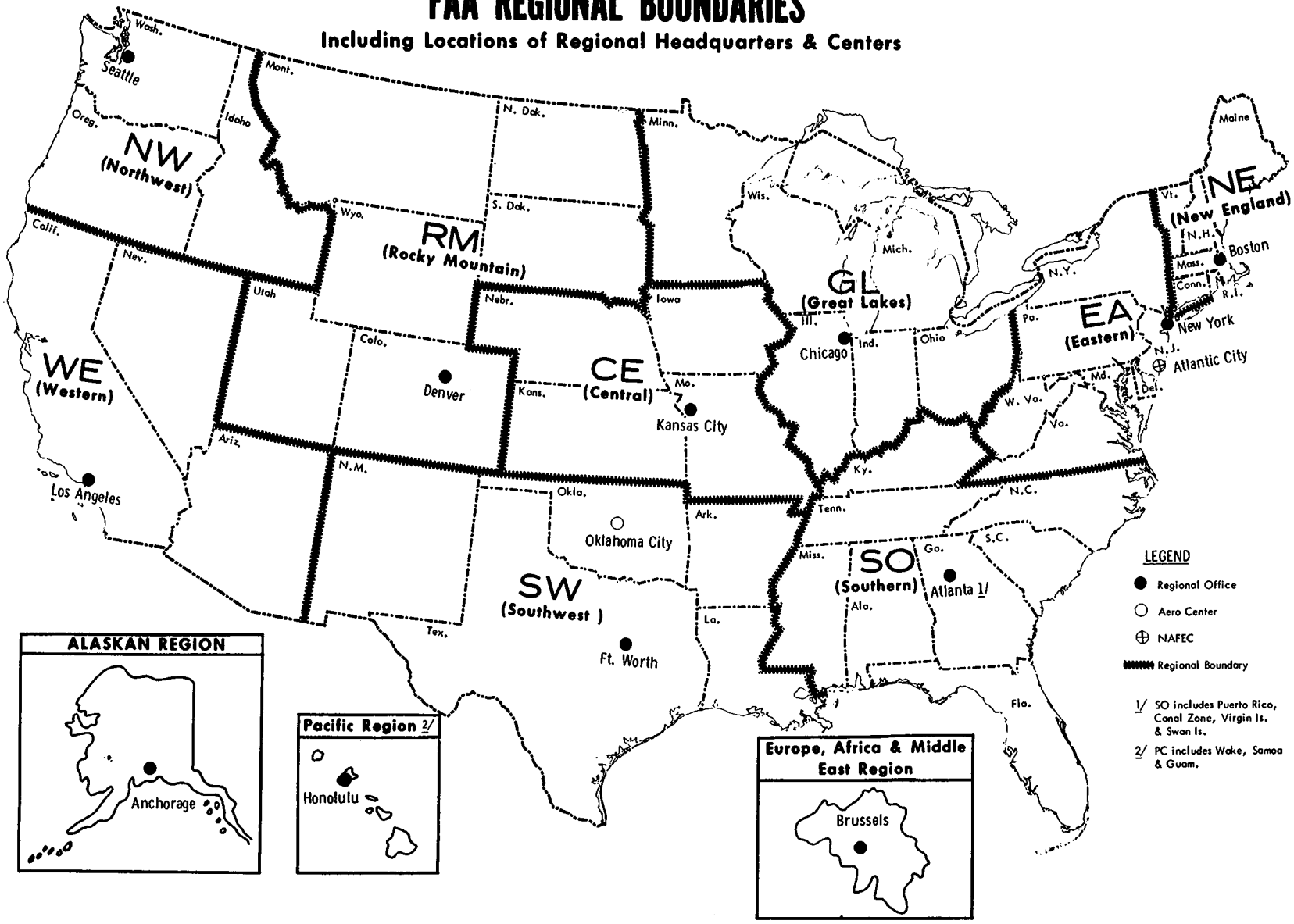
PARTS SOLD ON SINGLE-SALE BASIS

| Part | Title | Catalog Number | Publication date |
|---|---|---|---|
| 11 | General rulemaking procedures | TD 4.6:11 | May 1974 |
| | Change 1 | TD 4.6:11/Ch 1 | Feb. 1, 1974 and Jan. 1, 1975 |
| 13 | Enforcement procedures | TD 4.6:13 | do |
| 27 | Airworthiness standards: Normal category rotorcraft | TD 4.6:27 | August 1974 |
| | Change 1 | TD 4.6:27/Ch 1 | Oct. 31, 1974 |
| 29 | Airworthiness standards: Transport category rotorcraft | TD 4.6:29 | August 1974 |
| | Change 1 | TD 4.6:29/Ch 1 | Oct. 31, 1974 |
| 31 | Airworthiness standards: Manned free balloons | TD 4.6:31 | August 1974 |
| 35 | Airworthiness standards: Propellers | TD 4.6:35 | do |
| 39 | Airworthiness directives | TD 4.6:39 | May 1974 |
| 45 | Identification and registration marking | TD 4.6:45 | do |
| 49 | Recording of aircraft titles and security documents | TD 4.6:49 | do |
| 67 | Medical standards and certification | TD 4.6:67 | September 1974 |
| 71 | Designation of Federal airways, area low routes, controlled airspace, and reporting points | TD 4.6:71 | January 1975 |
| | Change 1 | TD 4.6:71/Ch 1 | July 28, 1975 |
| 73 | Special use airspace | TD 4.6:73 | January 1975 |
| | Change 1 | TD 4.6:73/Ch 1 | July 28, 1975 |
| 75 | Establishment of jet routes and high area routes | TD 4.6:75 | January 1975 |
| 77 | Objects affecting navigable airspace | TD 4.6:77 | do |
| 95 | IFR altitudes | TD 4.6:95 | do |
| | Change 1 | TD 4.6:95/Ch 1 | Feb. 13, 1975 |
| 97 | Standard instrument approach procedures | TD 4.6:97 | January 1975 |
| 99 | Security control of air traffic | TD 4.6:99 | March 1974 |
| 101 | Moored balloons, kites, unmanned rockets, and unmanned free balloons | TD 4.6:101 | do |
| | Change 1 | TD 4.6:101/Ch 1 | Aug. 20, 1974 |
| 107 | Airport security | TD 4.6:107 | March 1974 |
| 129 | Operations of foreign air carriers | TD 4.6:129 | April 1974 |
| | Change 1 | TD 4.6:129/Ch 1 | Oct. 9, 1975 |
| 137 | Agricultural aircraft operations | TD 4.6:137 | November 1974 |
| 143 | Ground instructors | TD 4.6:143 | September 1974 |
| 145 | Repair stations | TD 4.6:145 | January 1974 |
| 147 | Aviation maintenance technician schools | TD 4.6:147 | September 1974 |
| 149 | Parachute lofts | TD 4.6:149 | January 1974 |
| 151 | Federal aid to airports | TD 4.6:151 | December 1974 |
| 153 | Acquisition of U.S. land for public airports | TD 4.6:153 | do |
| 154 | Acquisition of U.S. land for public airports under the Airports and Airway Act of 1970 | TD 4.6:154 | do |
| 155 | Release of Airport property from surplus property disposal | TD 4.6:155 | do |
| 157 | Notice of construction, alteration, activation, and deactivation of airports | TD 4.6:157 | January 1975 |
| 159 | National Capital airports | TD 4.6:159 | December 1974 |
| 169 | Expenditure of Federal funds for nonmilitary airports or air navigational facilities thereon | TD 4.6:169 | January 1975 |
| 171 | Non-Federal navigation facilities | TD 4.6:171 | do |
| | Change 1 | TD 4.6:171/Ch 1 | Aug. 19, 1975 |
| 183 | Representatives of the Administrator | TD 4.6:183 | May 1974 |
| 185 | Testimony by employees and production of records in legal proceedings and service of legal process and pleadings | TD 4.6:185 | do |
| 187 | Fees | TD 4.6:187 | do |
| 189 | Use of Federal Aviation Administration communication system | TD 4.6:189 | do |

Department of Transportation - Federal Aviation Administration

# FAA REGIONAL BOUNDARIES

## Including Locations of Regional Headquarters & Centers



## DEPARTMENT OF TRANSPORTATION
### Federal Aviation Administration

# FAA Regional Offices, Flight Standards District Offices, Air Carrier District Offices, General Aviation District Offices, and International Field Offices

## REGIONAL OFFICES

### EASTERN REGION
Federal Building
John F. Kennedy International Airport
Jamaica, New York 11430
Tel. 212-995-3333

Area: Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, Virginia, West Virginia

### NEW ENGLAND REGION
12 New England Executive Park
Burlington, Massachusetts 01803
Tel. 617-273-7244

Area: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont

### SOUTHERN REGION
3400 Whipple St.
East Point, Georgia 30344
Tel. 404-526-7240

Mail: P.O. Box 20636
Atlanta, Georgia 30344

Area: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee

### ALASKAN REGION
Hill Building—632 Sixth Avenue
Anchorage, Alaska 99501
Tel. 907-272-5561

### CENTRAL REGION
601 East 12th Street
Kansas City, Missouri 64106
Tel. 816-374-5626

Area: Iowa, Kansas, Missouri, Nebraska

### NORTHWEST REGION
FAA Building, King County International Airport
Seattle, Washington 98108
Tel. 206-767-2780

Area: Idaho, Oregon, Washington

### SOUTHWEST REGION
4400 Blue Mound Rd.
P.O. Box 1689
Fort Worth, Texas 76101
Tel. 817-624-4911

Area: Arkansas, Louisiana, New Mexico, Oklahoma, Texas

### EUROPE, AFRICA, & MIDDLE EAST REGION
FAA, 1 Place Madou,
1000 Brussels, Belgium
Tel. 13.38.30, Ext. 300 or 301

U.S. Mailing Address:
American Embassy—FAA
APO New York 09667

### GREAT LAKES REGION
2300 E. Devon Avenue
Des Plaines, Illinois 60018
Tel. 312-694-4500

Area: Illinois, Indiana, Minnesota, Michigan, Ohio, Wisconsin

### ROCKY MOUNTAIN REGION
10455 E. 25th Avenue
Aurora, Colorado 80010
Tel. 303-297-3646

Area: Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming

### WESTERN REGION
15000 Aviation Blvd.
Hawthorne, California 90261
Tel. 213-536-6207

Mail: P.O. Box 92007 Worldway Postal Center
Los Angeles, Calif. 90009

Area: Arizona, California, Nevada

### PACIFIC-ASIA REGION
1833 Kalakaua Avenue
P.O. Box 4009
Honolulu, Hawaii 96813
Tel. 808-955-0401

## FLIGHT STANDARDS DISTRICT OFFICES (FSDO)
### (Combined Air Carrier and General Aviation District Offices)

**ALASKA**—Fairbanks 99701: 3788 University Ave.; Tel. 907-452-1276

Juneau 99801: Terminal Bldg., Juneau Municipal Arpt.; Tel. 907-586-3700/3755

**ARIZONA**—Phoenix: 15041 N. Arpt. Dr.; Scottsdale, Ariz. 85260; Tel. 602-261-4763

**CALIFORNIA**—Long Beach 90806: Long Beach Arpt., 2815 E. Spring St.; Tel. 213-426-7134

Oakland 94614: Oakland Int'l Arpt. P.O. Box 2397 Airport Station; Tel. 415-569-8879

San Diego 92123: 3750 John J. Montgomery Drive; Tel. 714-293-5280

Van Nuys 91406: 7120 Havenhurst Ave.; Tel. 213-785-8624

**DISTRICT OF COLUMBIA**—Washington 20001: West Bldg., Room 152, Washington National Arpt.; Tel. 202-628-1555

**HAWAII**—Honolulu 96819: P.O. Box 9728, Air Service Corporation Bldg., 218 Lagoon Drive; Tel. 808-847-0615

**MICHIGAN**—Detroit: Willow Run Arpt., Ypsilanti, Mich. 48197; Tel. 313-485-2550

**MISSOURI**—St. Louis: 9275 Genaire Drive, Berkeley, Mo. 63134; Tel. 314-425-7100

**NEW YORK**—Rochester 14624: Rochester-Monroe County Arpt.; Tel. 716-235-3438

**OHIO**—Cleveland 44135: 21046 Brookpark Road, Tel. 216-267-3700

**PUERTO RICO**—San Juan: Loiza Expressway; RFD No. 1 P.O. Box 29A, Loiza Station, Santurce 00914, Tel. 809-791-0374/5

**TENNESSEE** — Nashville 37217: 322 Knapp Blvd., Nashville Metro. Arpt.; Tel. 615-749-5661

**WASHINGTON**—Seattle 98108: King County Int'l Arpt., FAA Bldg.; Tel. 206-767-2747/2570

## AIR CARRIER DISTRICT OFFICES (ACDO)

**ALASKA**—Anchorage 99502: Amick Bldg., 4510 Intl Arpt Rd.; Tel. 907–279–4919

**CALIFORNIA**—Los Angeles 90045: 5885 W. Imperial Highway; Tel. 213–536–6590

San Francisco: 831 Mitten Rd., Room 105, Burlingame, Calif. 94010; Tel. 415–692–2441 x462

**COLORADO** — Denver: 2525 Geneva Street, Aurora, Colo. 80010; Tel. 303–837–4101/2

**DELAWARE** — Wilmington: Greater Wilmington Airport, Atlantic Aviation Office Bldg., New Castle, Del. 19720; Tel. 302–571–6357

**FLORIDA** — Miami 33159: P.O. Box 59015, FAA/Nat'l Weather Service Bldg. 3050, Miami Int'l Arpt.; Tel. 305–526–2605

**GEORGIA**—Atlanta 30327: Rm. 116, Suite D, 1568 Willingham Dr., Willingham Sq., College Park, Ga.; Tel. 404–526–7265

**ILLINOIS** — Chicago: 2300 E. Devon Avenue, Des Plaines, Ill. 60018; Tel. 312–694–4500

**MASSACHUSETTS** — Boston: Logan Intl. Arpt.; Gen. Aviation Admin. Bldg., East Boston, Mass. 02128; Tel. 617–223–6354

**MINNESOTA**—Minneapolis: Rm. 202, 6201 34th Ave., South Minneapolis, Minn. 55450; Tel. 612–725–3361

**MISSOURI**—Kansas City 64153: Kansas City Intl. Arpt., 525 Mexico City Ave.; Tel. 816–243–3800

**NEW JERSEY** — Newark 07114: Rm. 220 Airmail & Express Terminal, Newark Arpt.; Tel. 201–645–2560

**NEW YORK**—Jamaica 11430: PONY Bldg. #141, John F. Kennedy Intl. Arpt.; Tel. 212–995–3709

**NORTH CAROLINA** — Winston-Salem 27105: 2nd Floor Terminal Bldg., Smith Reynolds Arpt.; Tel. 919–723–9211 X 366/7

**OKLAHOMA**—Tulsa 74115: Rm. 208, Tulsa International Airport, Tel. 918–835–2378

**PENNSYLVANIA** — Pittsburgh 15231: Southwing Term. Bldg., Greater Pittsburgh Arpt.; Tel. 412–644–5406/7/8

**TENNESSEE**—Nashville 37217: Bldg. #3 of Hilton Arpt. Inn, 100 Jetway Drive, Nashville Metropolitan Airport, Tel. 615–749–5196

**TEXAS** — Dallas 75235: 3323 Grove Street; Tel. 204–357–8297

Fort Worth 76125: Rm. 213, Terminal Bldg., Greater Southwest Intl. Arpt., Box 2506; Tel. 817–283–4401

Houston 77017: Rm. 224, 8800 Paul B. Koonce Drive; Tel. 713–645–6628

## GENERAL AVIATION DISTRICT OFFICES (GADO)

**ALABAMA** — Birmingham 35206: Muni. Arpt. 6500 43rd Ave., North; Tel. 205–592–6371

**ALASKA**—Anchorage 99501: 1515 E. 13th Ave.; Tel. 907–272–1234 & 279–5213

**ARKANSAS**—Little Rock 72202: Room 201, FAA & Weather Service Bldg., Adams Fld.; Tel. 501–372–3437/8

**CALIFORNIA**—Fresno 93727: Fresno Air Terminal, 2401 North Ashley; Tel. 209–487–5306

Los Angeles: Suite 3, Muni. Arpt., 3200 Airport Ave., Santa Monica, Calif. 90405; Tel. 213–391–6701

Ontario 91761: Ontario Intl. Arpt.; Tel. 714–984–2411

Sacramento 95822: Executive Arpt.; Tel. 916–449–3169

San Jose 95110: 1387 Arpt. Blvd.; Tel. 408–275–7681

**COLORADO** — Denver: FAA Bldg., Jefferson Co. Arpt., Broomfield, Colo. 80020; Tel. 303–466–7326

**FLORIDA**—Jacksonville 32211: FAA Bldg., Craig Arpt., P.O. Box 8665 Tel. 904–641–7311

Miami: Bldg. 121, Opa Locka Arpt., P.O. Box 365, Opa Locka, Fla. 33054; Tel. 305–681–7431

**GEORGIA** — Atlanta 30336: FAA Bldg., Rm. 200; Fulton Co. Arpt.; 3999 Gordon Rd., S.W.; Tel. 404 691–2323

**IDAHO** — Boise 83705: 3113 Arpt. Way; Tel. 208–342–2711 X 238

**ILLINOIS** — Chicago: DuPage Co. Arpt., P.O. Box H; West Chicago, 60185; Tel. 312 584–4490/1/2

Springfield 67205: Capital Airport, New Terminal; Tel. 217–525–4238

**INDIANA**—Indianapolis 46241: FAA Bldg. #1, Municipal Airport, P.O. Box 41525; Tel. 317–247–2491

South Bend 46628: 1843 Commerce Drive; Tel. 219–232–5843

**IOWA**—Des Moines 50321: 3021 Army Post Rd.; Tel. 515–284–4094

**KANSAS**—Kansas City 66115: Room 100, Admin. Bldg., Fairfax Arpt.; Tel. 913–281–3491/2

Wichita 67209: Flight Standards Bldg., Municipal Airport; Tel. 316 943–3244

**KENTUCKY** — Louisville 40205: 2nd Fl., Central Am. Hangar Bowman Fld.; Tel. 502–582–6116/7/8

**LOUISIANA**—Lafayette 70501: Lafayette Arpt.; Tel. 318–234–2321

New Orleans 70126: Rm. 227, New Orleans Lakefront Arpt. Tel. 504–241–2506

Shreveport 71107: Rm. 202, Terminal Bldg., Downtown Arpt.; Tel. 318–222–8370/79

**MAINE** — Portland 04102: General Aviation Terminal, Portland Intl. Jetport; Tel. 207–774–4484

**MARYLAND** — Baltimore 21240: Baltimore-Washington Int'l Arpt.; Tel. 301–761–2610

**MASSACHUSETTS** — Norwood 02062: Muni. Arpt.; Tel. 617–762–2436/2675

Westfield 01085: 1st Floor Terminal Bldg., Barnes Muni. Arpt.; P.O. Box 544; Tel. 413–568–3121

**MICHIGAN** — Grand Rapids 49508: Kent Co. Arpt., 5500 44th St., SE.; Tel. 616–456–2427

**MINNESOTA** — Minneapolis 55450: Wold-Chamberlain Arpt., Room 201, 6201 34th Avenue South; Tel. 612–725–3341

**MISSISSIPPI**—Jackson 39208: FAA Bldg., Municipal Arpt., Allen C. Thompson Fld., P.O. Box 6273, Pearl Branch; Tel. 601–939–5231

**MONTANA** — Billings 59101: Rm. 216 Admin. Bldg., Billings-Logan Int'l Arpt.; Tel. 406–245–6170/9

Helena 59601: Rm. 3, FAA Bldg., Helena Arpt.; Tel. 406–442–4230

**NEBRASKA** — Lincoln 68524: Gen. Aviation Bldg., Lincoln Muni. Arpt.; Tel. 402–471–5485

**NEVADA**—Las Vegas 89119: 5700 C South Haven; Tel. 702–736–0666

Reno 89502: 2601 East Plumb Lane; Tel. 702–784–5321

**NEW JERSEY** — Teterboro 07608: 150 Riser Road; Tel. 201–288–1745/1874

**NEW MEXICO** — Albuquerque 87119: International Arrivals Bldg., P.O. Box 9045; Tel. 505–247–0156/7

**NEW YORK** — Albany 12211: Albany Co. Arpt.; Tel. 518 869–8482

Farmingdale 11735: Bldg 53, Republic Airport; Tel. 516 691–3100

**NORTH CAROLINA** — Charlotte 28208: FAA Bldg., Muni. Arpt.; Tel. 704–392–3214/5

Raleigh 27611: Rm. 324, Terminal Bldg., Raleigh-Durham Arpt., P.O. Box 26807; Tel. 919–755–4240

**NORTH DAKOTA** — Fargo 58102: Rm. 216, Admin. Bldg., Hector Fld., P.O. Box 5496; Tel. 701–232–8949

**OHIO** — Cincinnati 45226: Lunken Arpt. Executive Bldg.; 4242 Airport Rd.; Tel. 513–684–2183

Columbus 43219: 424 Lane Aviation Bldg., Port Columbus Arpt., Tel. 614–469–7476/7

**OKLAHOMA** — Oklahoma City: FAA Bldg., Wiley Post Arpt., Bethany, Okla. 73008; Tel. 405–789–5220/1/2

Tulsa 74115: General Aviation Terminal, Rm. 110, Tulsa Intl. Arpt.; Tel. 918–835–7619

**OREGON** — Eugene 97402: Mahlon Sweet Arpt., Rt. 1, Box 717; Tel. 503–688–9721

Hillsboro 97123: 3355 N. E. Cornell Road; Portland-Hillsboro Arpt.; Tel. 503–221–2104

**PENNSYLVANIA** — Allentown 18103: Allentown-Bethlehem-Easton Arpt.; Tel. 215 264–2888

Harrisburg: Rm. 201, Admin. Bldg., Capital City Airport, New Cumberland, Pa. 17070; Tel. 717–782–4528

Philadelphia 19114: North Philadelphia Arpt.; Tel. 215–673–0250/1/2

Pittsburgh: Room 213, Allegheny Co. Arpt., West Mifflin, Pa. 15122; Tel. 412–461–5507

**SOUTH CAROLINA** — Columbia: Metropolitan Arpt., Box 200, West Columbia, S.C. 29169; Tel. 803–794–9042

**SOUTH DAKOTA** — Rapid City 57701: Regional Arpt., R.R. 2, Box 633B Tel. 605–343–2403

**TENNESSEE** — Memphis 38130: 2488 Winchester, P.O. Box 30050; Tel. 901–398–2353

**TEXAS**—Corpus Christi 78410: Bledsoe Hangar No. 3, Intl. Arpt.; Tel. 512–884–9331/2

Dallas 75232: Redbird Arpt.; Tel. 214–339–7164

El Paso 79925: Rm. 202, FAA Aviation Bldg., 6795 Convair Rd.; Tel. 915–778–6389

Fort Worth 76106: Rm. 201, Admin. Bldg., Meacham Fld.; Tel. 817–624–1184/5

Houston 77017: 8800 Paul Koonce Dr., Tel. 713–643–6504

Lubbock 79401: P.O. Box 194Z Executive Air Terminal, Rt. #3; Tel. 806–762–0335

Midland 79701: Midland Regional Air Terminal; Tel. 915–563–0802

San Antonio 78216: 1115 Paul Wilkins Rd., Room 201; Tel. 512–824–9535/6/7

**UTAH**—Salt Lake City 84116: 116 North 2400 West, Room 103; Tel. 801–524–4247

**VIRGINIA** — Richmond: Byrd Fld., Sandston, Va. 23150; Tel. 804–222–7494

**WASHINGTON**—Spokane 99206: 5629 E. Rutter Avenue; Tel. 509–456–4618

**WEST VIRGINIA** — Charleston 25311: Kanawha Co. Arpt.; Tel. 304 343–4689

**WISCONSIN** — Milwaukee 53207: General Mitchell Fld.; Tel. 414 747–5531

**WYOMING** — Casper 82601: 1187 Fuller St., Casper Air Terminal; Tel. 307 234–8959

## INTERNATIONAL FIELD OFFICES (IFO)

**ALASKA**—Anchorage 99502: 4800 International Airport Rd.; Tel. 907–274–4123

**NEW YORK**—Valley Stream 11581: 181 South Franklin Ave.; Tel. 212–995–8529



☆U.S. GOVERNMENT PRINTING OFFICE: 1992-621-990/60028