GYROPLANE FLIGHT INSTRUCTOR EXAMINATION GUIDE

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SUBJECT: GYROPLANE FLIGHT INSTRUCTOR EXAMINATION GUIDE

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1. PURPOSE. This advisory circular is being issued to:

   a. Outline the scope of the basic aeronautical knowledge requirements for a gyroplane flight instructor

   b. Acquaint the applicant with source material that may be used to acquire this basic knowledge, and

   c. Present a sample examination, answers and explanations to the sample examination test items, and many illustrations used in the current Flight Instructor - Rotorcraft-Gyroplane Written Examinations.

2. HOW TO GET THIS PUBLICATION.

   a. Order copies of this publication from:

   Office of Headquarters Operations, HQ-438
   Federal Aviation Agency
   Washington, D. C. 20553

   b. Identify the publication in your order as:

   FAA Advisory Circular AC 61-33
   Gyroplane Flight Instructor Examination Guide

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CHAPTER 1. NATURE OF THE WRITTEN EXAMINATION

1. INTRODUCTION. This study guide was prepared by the Flight Standards Service of the Federal Aviation Agency to assist applicants who are preparing for the Flight Instructor Rotorcraft-Gyroplane Written Examination. It was prepared by the same personnel who were responsible for developing the Flight Instructor Rotorcraft-Gyroplane Written Examination currently in use.

   This guide is not offered as a quick and easy way to obtain the necessary knowledge for passing the written examination. There is no quick and easy way to obtain the background of experience, knowledge, and skill that the professional flight instructor must acquire in order to provide the high quality of training necessary to transform today's student into tomorrow's proficient pilot. Rather, the intent of this guide is to define the scope and narrow the field for study, insofar as possible, to the basic knowledge requisite to obtaining a flight instructor certificate.

2. CERTIFICATE REQUIREMENTS. The general qualifications for a flight instructor certificate require of the applicant a combination of experience, knowledge, and skill. An applicant for a flight instructor certificate with a rotorcraft rating should carefully review the applicable sections of Federal Aviation Regulations, Part 61, for detailed information pertaining to this subject.

3. TYPE OF EXAMINATION. The Flight Instructor Rotorcraft-Gyroplane Written Examination is necessarily comprehensive because the flight instructor must be knowledgeable in many areas. He must know not only "what" to do and "how" to do it; he must know also "why" a maneuver or procedure is performed in a certain order; what the results may be if the maneuver or procedure is not performed properly; and what elements of performance should be carried over from each training maneuver and procedure into the student's future day to day flying to ensure the safest possible pilot. It is generally accepted that a pilot with much knowledge but little skill is not adequately equipped for day-to-day flying. Today the pilot who is skillful in only the manipulative techniques of flying and lacking in aviation knowledge is not a very skillful airman with safety as his watchword.

   In addition to his aviation qualifications, the flight instructor must be capable and well versed in one highly important area that is not required for any other pilot certificate. The flight instructor must be a teacher. He must have an understanding of the learning process, the basic teaching

principles, and the general application of these principles to teach his students effectively. There is much truth in the saying, "If there is no learning, there is no teaching."

The gyroplane flight instructor examination is divided into two sections: Section 1, "Fundamentals of Flight Instruction" and Section 2, "Performance and Analysis of Flight Training Maneuvers." A detailed outline of the subject areas covered in each section appears later in this guide.

The time required for the examination is approximately 4 hours. Examination test items are of the objective, multiple-choice type, and each can be answered by the selection of a single item as the correct choice. This method conserves the applicant's time, the scorer's time, and eliminates the element of individual judgment in determining grades.

4. TAKING THE EXAMINATION. In addition to being an exercise in the application and use of aeronautical knowledge, an examination is also an exercise in communication since it involves the use of written language. Communication between individuals through the use of such abstract symbols as words is indeed a complicated process; so complicated, in fact, that at times communication may either break down or mislead if care is not exercised. The same word often means different things to different people. Carefully read the information and instructions.

Always bear in mind the following facts when you are taking the examination:

a. The test items are not trick questions. Each statement means exactly what it says. Read each test item stem and each alternate response carefully, but do not look for hidden meanings. The correct statement does not concern exceptions to the rule; it refers to the general rule. However, the incorrect responses are often based on the exceptions.

b. First, carefully read the test item stem before you look at the alternate responses listed below it. Be sure that you understand what the question asks. Then decide what the correct answer should be or work out the problem to obtain the answer. Finally, look through the list of alternate responses or phrases and select the one that says the same thing as your answer. Be sure that the one you select answers the test item completely.

c. Only one of the alternate responses given is completely correct. The others may be answers that result from incorrect procedure (in a problem, for example) or from lack of knowledge pertaining to the

test item, or from popular misconceptions. Understand the test item and then select the response you consider to be the best answer.

d. If you find that you have considerable difficulty with a particular test item, do not spend too much time on it, but continue with the examination and answer those test items which are less difficult. Then go back and reconsider the test items you have passed over. This procedure will enable you to use the total time available to maximum advantage in demonstrating your knowledge and understanding of the subject.

CHAPTER 2. STUDY OUTLINE FOR THE FLIGHT INSTRUCTOR ROTORCRAFT-GYROPLANE WRITTEN EXAMINATION

SECTION 1. FUNDAMENTALS OF FLIGHT INSTRUCTION

5. FLIGHT INSTRUCTOR'S HANDBOOK, AC 61-16. Applicants should familiarize themselves with the following pertinent chapters of this Handbook:

NOTE: All specific references and examples in this Handbook are based on airplanes; however, the general material is applicable to flight instructors in other aircraft categories.

a. Fundamentals of Teaching and Learning (Chapter I).

b. Effective Teaching Methods (Chapter II).

c. Aeromedical Information Important to Flight Instructors (Chapter IV).

d. The Flight Training Syllabus (Chapter VI).

e. Flight Instructor Responsibilities (Chapter VII).

SECTION 2. PERFORMANCE AND ANALYSIS OF FLIGHT TRAINING MANEUVERS

6. AERODYNAMICS. Have a knowledge and understanding of:

a. Aerodynamic terms and definitions.

b. Gyroplane loading.

(1) Weight and balance and flight performance.

(2) Effects of load on gyroplane structure.

(3) Effects of loading on stability and controllability.

(4) Load factor principles.

c. Forces acting on a gyroplane in flight.

d. The gyroplane's axes of rotation.

e. Functions of the controls and cyclic trim.

f. Angle of attack.

g. Airspeed.

(1) Relationship to control effectiveness and rotor blade stall.

(2) Maneuvering (V_A - formerly V_p)--if applicable.

(3) Best rate-of-climb (V_y).

(4) Best angle-of-climb (V_x).

(5) Minimum level flight.

(6) Relationship between speed, angle of bank, and rate of turn.

h. Turns.

(1) Forces acting on an aircraft in a normal turn.

(2) Changes of lift in a turn.

(3) Changes of drag in a turn.

(4) Changes of load factor in a turn.

(5) Slipping and skidding.

i. Torque.

(1) Propeller.

(2) Rotor.

j. Gyroscopic precession.

(1) Principles.

(2) Relationship of cyclic control movements, rotor blade pitch changes, and rotor reaction.

k. Controllable propellers.

(1) How a propeller works.

(2) Purpose of controllable propellers.

(3) Operation of controllable propellers--the relationship between manifold pressure, RPM, and Brake Mean Effective Pressure (BMEP).

7. FLIGHT TRAINING MANEUVERS AND PROCEDURES.

a. Know how and when to introduce maneuvers and procedures (Item e below).

b. Know the correct technique for the maneuvers and procedures.

c. Be able to recognize and analyze common student errors.

d. Be familiar with effective methods of correcting student errors.

e. Know the required maneuvers and procedures.

(1) Preflight operations (including check of gyroplane documents and records), starting, warm-up, taxi, before takeoff, inflight, and postflight checks and procedures.

(2) Use of radio for voice communication.

(3) Straight-and-level flight and turns.

(4) Climbs and descents (including power-off descents).

(5) Ground track maneuvers.

(a) Turns about a point, including 720° steep turns.

(b) Gliding spirals about a point on the ground.

(c) Traffic patterns.

(6) Takeoffs and landings.

(a) Normal.

(b) Crosswind.

(c) Short-, soft-, and rough-field.

(d) Jump takeoffs.

(e) Running takeoffs.

(f) Roll-on landings.

(g) Full-flare landings.

(h) Go-arounds (balked landings).

(i) Emergencies.

(j) Solo flight.

(7) Steep turns including 720° power turns.

(8) Entry and recovery from high rates of descent with and without power.

(9) Maneuvering at minimum level flight airspeed.

(10) Emergencies.

(11) Cross-country flying.

(a) Cross-country planning.

(b) Cross-country flying.

(c) Cross-country emergencies (lost, weather, overheating engine, power failure, etc.).

(d) Use of radio aids to VFR navigation.

8. USE OF RADIO. Understand the basic characteristics, operations, frequency spectrum, advantages, and limitations of:

   a. VHF communications equipment.

      (1) The "line-of-sight" range of transmissions.

      (2) Understand how to utilize VHF/DF (direction finding) service and radar assistance from ground stations.

   b. VOR equipment.

      (1) Understand the meaning of the radio class designations of "H", "L", and "T" for VOR/VORTAC/TACAN stations.

      (2) Know the components of the VOR receiver.

      (3) Understand a radial as a line of magnetic bearing extending from a VOR station.

      (4) Understand how to determine your approximate position relative to the station by interpreting the setting of the bearing selector, the position of the LEFT-RIGHT Needle, and the indication of the TO-FROM Indicator.

      (5) Understand the use of VOR for time and distance checks and for off-course navigation.

      (6) Understand the methods of checking VOR receiver accuracy.

   c. L/MF range and ADF equipment -- Understand:

      (1) How to determine the magnetic directions of the four legs of L/MF radio ranges and the relative positions of the "A" and "N" quadrants.

      (2) How to interpret bi-signals and on-course and off-course signals.

      (3) The importance of the station identification signal in quadrant identification and orientation problems.

      (4) How to interpret bearing information when using ADF.

      (5) The use of ADF in checking time and distance to radio stations.

(6) Tracking outbound and inbound on ADF.

(7) Operational characteristics and precautions to observe in use of L/MF radio equipment.

9. USE OF PILOT INFORMATION PUBLICATIONS.

a. Airman's Information Manual--Know how to use and interpret the data contained in this important publication, such as:

(1) Air navigation radio aids (NAVAIDS).

(2) Airport and air navigation lighting and marking aids.

(3) Altimetry.

(4) Good operating practices.

(5) Radar.

(6) Radiotelephone phraseology and techniques.

(7) Safety of flight.

(8) Weather.

(9) ATC operations and procedures.

(10) Flight data and special operations.

(11) Notices to Airmen (NOTAMS).

(12) Airport Directory.

(13) Airport/Facility Directory.

b. Gyroplane Flight Manual--As applicable to the gyroplane in the instruction program, understand the material in this manual and how to use it.

(1) Know how to consult the weight and balance data to determine that the aircraft is properly loaded. Know how to compute empty weight, useful load, and gross weight. Know how to compute moments from weights and center of gravity arms.

(2) Know the grade and quantity of fuel and oil required.

(3) Know flight load factor limitations and airspeed limitations.

(4) Be able to use performance charts as required for:

(a) Takeoff data.

(b) Climb data.

(c) Landing distance data.

(d) Cruise performance data.

(e) Be able to use and interpret such charts as the

(1) Height vs. velocity chart.

(2) Airspeed calibration chart.

c. Federal Regulations governing aviation. The rotorcraft flight instructor should be familiar with the following Civil Aeronautics Board Regulations and Federal Aviation Regulations:

(1) Civil Aeronautics Board, Safety Investigation Regulations, Part 320.

(2) Federal Aviation Regulations

(a) Part 1, "Definitions and Abbreviations."

(b) Part 61, "Certification: Pilots and Flight Instructors."

(c) Part 91, "General Operating and Flight Rules."

(d) Part 27, "Airworthiness Standards: Normal Category Rotorcraft."

10. AIRFRAME AND POWERPLANT. Have a working knowledge of:

a. Aircraft structures.

b. Airframe components and control surfaces.

c. Rotor systems.

d. Fuel and fuel systems.

e. Oil and oil systems.

f. Electrical system fundamentals.

g. Reciprocating engine principles and components.

h. Carburetion and fuel injection.

i. Ignition.

j. Propellers.

k. Engine instruments.

11. OTHER AREAS OF IMPORTANCE.

a. The altimeter.

(1) Know the effect of nonstandard temperature and pressure on the indications of the altimeter.

(2) Understand how to apply altimeter settings to the Kollsman window of the altimeter.

(3) Understand how to obtain the pressure altitude.

(4) Be able to interpret the indications of the altimeter at all altitudes (including altitudes above 10,000 feet).

b. The airspeed indicator.

(1) Know the airspeed limitations that are reflected by the standard marking system on the face of the airspeed indicator.

(a) Caution range.

(b) Never-exceed speed (V_{ne}).

(2) Know and understand the reason for other pertinent airspeed limitations such as the maneuvering speed (V_A - formerly V_p).

c. The magnetic compass.

(1) Know how to read correctly and use to maintain direction.

(2) Know the inherent errors.

d. Aircraft stability--Understand about both static and dynamic stability.

e. Vibrations associated with the rotor.

f. Meaning of colored lights at an airport.

(1) Runway.

(2) Taxiway.

(3) Threshold.

(4) Beacon.

(5) Visual approach slope indicator.

(6) Nonstandard traffic light (controlled airports).

(7) Obstruction.

g. Understand and be able to use pertinent charts, such as:

(1) Density altitude charts.

(2) Load factor chart.

h. Safe flying practices. Have a thorough understanding of

(1) Density altitude and its effects on aircraft performance.

(a) Understand that density altitude INCREASES with a decrease in pressure, increase in temperature, or an increase in relative humidity.

(b) Understand that if density altitude increases, aircraft performance DECREASES.

(2) Carburetor icing

(a) Symptoms in aircraft with fixed-pitch propellers and with constant-speed propellers.

(b) Use of carburetor heat.

(3) Know the effects of snow, ice, and frost on an airfoil, and realize the importance of their removal prior to flight.

(4) Dangers associated with aircraft wake turbulence--(i.e., wing-tip vortices; propeller, jet engine, and helicopter rotor wash)--

(a) Conditions and circumstances most conducive to such turbulence.

(b) How to avoid these dangers.

(c) Procedure to use if inadvertently encountered.

(5) Fuel contamination.

(a) Causes.

(b) Precautions to take.

(6) Know the advantages of maintaining clean rotor blades.

APPENDIX 1. RECOMMENDED STUDY MATERIALS

The applicant for the Rotorcraft Flight Instructor rating will find the publications listed below helpful to him in his preparation for the examination.

The list identifies source material essential to preparing for the examination but does not include all available material on the subjects. Other excellent textbooks, audiovisual training aids, and instruction materials useful in preparing for the examination are available at bookstores and libraries.

It is the responsibility of each applicant to obtain the study materials appropriate to his needs.

NOTE: References listed were available at the time this publication went to press.

SECTION 1. LIST OF APPROPRIATE STUDY MATERIALS

1. AIRMAN'S INFORMATION MANUAL (annual subscription: $13 domestic; $16.25 foreign). This FAA publication, known as the "AIM", provides extensive information for the planning and conduct of flights in the Federal Airway System. Pilots, both novice and "old timers," will find it a valuable guide and especially useful in preflight and inflight planning and operations. The manual is designed to be carried in the cockpit and is published in sections and looseleaf style to permit removal of selected portions for easy carrying. Updating pages can readily be inserted as these are received from FAA. The basic manual provides fundamentals of aeronautical knowledge useful to both novice and experienced pilots. Five other sections offer procedural and directory information about airports, navigation facilities, and weather forecast services.

   The Airman's Information Manual is sold as three separate subscriptions or parts. You may subscribe to one or to all three, depending on your individual needs.

   PART I - Basic Flight Manual and ATC Procedures.
   Combines the present Sections I and II and is issued quarterly. The price of an annual subscription is $2.00 (foreign mailing 50 cents additional).

   PART II - Airport Directory.
   A revised version of the present Section IV, Airport Directory, expanded to include the physical description of those airports now only in Section IV-A. This part is issued semiannually, and the price for an annual subscription is $2.00 (foreign mailing 50 cents additional).

PART III - Operational Data and Notices to Airmen
Offers the present Sections IV-A, III and III-A every 28 days, supplemented by Section III-A, Notices to Airmen, every 14 days midway between the 28-day cycle. The annual subscription price is $9.00 (foreign mailing $2.25 additional).

Mailing is scheduled so that the publications will arrive at intervals several days apart.

2. FLIGHT INSTRUCTOR'S HANDBOOK, AC 61-16 (60¢). This revised handbook is one of the primary sources of information and guidance for pilots preparing for the flight instructor certificate and is also valuable as a reference text for certificated flight instructors. It is basically a book which deals with accepted theories and practices applicable to teaching and the learning process. As such it is the primary reference text when preparing for the "Fundamentals of Instruction" section of the Flight Instructor Written Examination.

3. FLIGHT TRAINING HANDBOOK, AC 61-21 (70¢). This text deals with certain basic flight information such as load factor principles, weight and balance, and related aerodynamic aspects of flight, as well as principles of safe flight. The balance of the book provides information and direction in the introduction and performance of training maneuvers. Thus it serves as a text for student pilots, pilots improving their qualifications or preparing for additional ratings, and flight instructors who are teaching. Although written primarily for the airplane pilot, portions of it are adaptable to the gyroplane pilot.

4. BASIC HELICOPTER HANDBOOK, AC 61-13 (75¢). This handbook is to the helicopter pilot what the Flight Training Handbook is to the airplane pilot. Although written primarily for the helicopter pilot, portions of it are adaptable to the gyroplane pilot.

5. FEDERAL AVIATION REGULATION:

   a. Part 1 -- Definitions and Abbreviations (25¢).

   b. Part 61 -- Certification: Pilots and Flight Instructors (50¢)

   c. Part 91 -- General Operating and Flight Rules (30¢)

   d. Part 27 -- Airworthiness Standards - Normal Category Rotorcraft (45¢). Certain sections of this manual will prove most useful as a source of detailed information on the requirements pertaining to aircraft characteristics, performance, operation, operating limitations and rotorcraft flight manuals.

6. CIVIL AERONAUTICS BOARD SAFETY INVESTIGATION REGULATIONS, Part 320 (5¢) This CAB publication deals with procedures required in dealing with accidents and lost or overdue aircraft in the United States and outlying areas.

7. GYROPLANE FLIGHT MANUALS, OWNER'S MANUALS AND TRAINING MANUALS. Aircraft manufacturers issue Flight and/or Owner's Manuals for each aircraft model. They also often issue Training Manuals for their aircraft. These may be obtained from individual aircraft manufacturing companies or from local dealers and distributors.

8. VFR EXAM-O-GRAMS. Analyses and explanations of selected topics of aeronautical knowledge important to safety in flight operations presented in the form of questions and answers. These topics are selected when results of written pilot examinations indicate a need for clarification to correct common mistakes, misconceptions, and lack of information. Although slanted toward activities involving airplanes, most of the material is applicable to gyroplane operations. Exam-O-Grams are issued on an irregular basis and are distributed free of charge upon request. The following have been published as of the date of this examination guide:

NO.	TITLE
1.	CONTROL ZONE VFR WEATHER MINIMUMS
2.	VFR CRUISING ALTITUDES
3.	THE DANGERS OF WINGTIP VORTICES (AN INVISIBLE HAZARD TO LIGHT AIRCRAFT)
4.	PREFLIGHT PLANNING FOR A VFR CROSS-COUNTRY FLIGHT (Series 1)
5.	PREFLIGHT PLANNING FOR A VFR CROSS-COUNTRY FLIGHT (Series 2)
6.	PREFLIGHT PLANNING FOR A VFR CROSS-COUNTRY FLIGHT (Series 3)
7.	GETTING CAUGHT ON TOP OF AN OVERCAST
8.	AIRSPEED INDICATOR MARKINGS
9.	ALTIMETRY

10. FUEL CONTAMINATION

11. DENSITY ALTITUDE AND ITS EFFECT ON AIRCRAFT PERFORMANCE

12. THE MAGNETIC COMPASS

13. WEIGHT AND BALANCE

14. RADIO COMMUNICATIONS FREQUENCIES

15. HOW TO USE VOR (Series 1)

16. HOW TO USE VOR (Series 2)

17. COMMON MISCONCEPTIONS (Series 1)

18. LOST PROCEDURES - PILOTAGE

19. EMERGENCY OR LOST PROCEDURES (RADIO)

20. CEILING AND VISIBILITY

21. FLYING INTO UNFAVORABLE WEATHER

22. POTENTIAL MID-AIR COLLISIONS (Series 1)

23. INTERPRETING SECTIONAL CHARTS (Series 1)

24. INTERPRETING SECTIONAL CHARTS (Series 2)

25. INTERPRETING SECTIONAL CHARTS (Series 3)

26. COMMON MISCONCEPTIONS (Series 2)

27. THE EFFECT OF WIND ON AN AIRPLANE

28. FACTORS AFFECTING STALL SPEED

29. POTENTIAL MID-AIR COLLISIONS (Series 2)

30. FLIGHT PLANS (Series 1)

31. FLIGHT PLANS (Series 2)

32. SIGNPOSTS IN THE SKY

33. USE OF PERFORMANCE CHARTS

34. HOW TO OBTAIN PROPER WEATHER BRIEFING

SECTION 2. HOW TO OBTAIN STUDY MATERIALS

9. VFR EXAM-O-GRAMS. VFR Exam-O-Grams are non-directive in nature, and are issued solely as an information service to individuals interested in Airman Written Examinations. They are available free of charge (in limited quantities) by ordering from:

Flight Standards Technical Division
Operations Branch, AC-740
P. O. Box 1082
Oklahoma City, Oklahoma 73101

10. OTHER STUDY MATERIALS. All other study materials listed may be obtained by remitting check or money order to:

U. S. Government Printing Office
Superintendent of Documents
Washington, D. C. 20442

APPENDIX 2. SAMPLE EXAMINATION

The following test items are only samples to indicate the general form of those used in the examination. They are included for one purpose--to familiarize you with the type of test items you may expect to find on FAA examinations. Ability to answer these sample items does not indicate that you are fully prepared to take the examination since all topics on which you will be tested are not included.

You should concentrate on the section of this study guide entitled "Study Outline for the Flight Instructor Rotorcraft-Gyroplane Written Examination." A knowledge of all the topics mentioned in this outline--not just the mastery of the sample test items--should be used as the criterion for determining that you are properly prepared to take the FAA written examination. Proper preparation requires considerable time, effort, and the guidance of a competent instructor.

Correct answers to the sample test items, along with an explanation of each test item, are in this Appendix, pages 6 through 9. In some sample test items, reference will be made to certain illustrations. These illustrations will be found in Appendix 3 of this guide. They are representative of illustrations which may be found in the written examination and with which the applicant should be familiar.

SECTION 1. FUNDAMENTALS OF FLIGHT INSTRUCTION

TEST ITEM 1. Motivation is a key factor in learning. In properly motivating students, a flight instructor should remember that

1- students are innately able to evaluate their proficiency and rate of progress and will instinctively tend to arrive at correct self-concepts if properly motivated.
2- it is best to emphasize long range goals more than short range goals.
3- positive motivations are characteristically more effective than negative motivations.
4- all of the above statements are considered true.

TEST ITEM 2. Worry and emotional difficulties which are sometimes associated with flight training are usually a result of

1- personality problems of the student affected.
2- inadequacies in the training course or flight instructor.
3- personality conflicts between student and instructor.
4- the type of maneuvers, or the phase of training with which the student is concerned at the time the difficulties arise.

TEST ITEM 3. The flight instructor's first step in teaching is to

1- gain the student's confidence.
2- determine whether the student really wants to learn to fly.
3- teach the student to fly straight and level.
4- require the student to complete a short verbal or written quiz to test his ability to assimilate instruction.

TEST ITEM 4. If a student shows slow progress in learning to perform normal landings because of lack of confidence, his flight instructor should

1- continue the instruction on the landings but in a more energetic manner so that the student will apply himself with greater diligence.
2- use praise to a greater extent after each landing attempt.
3- assign him goals that are less difficult.
4- point out the student's errors by exaggerated demonstrations of the errors.

TEST ITEM 5. Flight instructors should understand that plateaus or slumps in a student's rate of learning

1- seldom occur, and when they do, are most likely to occur when the student reaches the advanced phase of instruction.
2- seldom occur and then only during the pre-solo stage.
3- are normal situations and are more likely to occur as the student advances to more complicated maneuvers.
4- occur frequently because students will not practice maneuvers that they do not enjoy.

TEST ITEM 6. Criticism of a poor or unsatisfactory flight performance

1- is the most dependable method of forcing flight students to apply themselves more diligently.
2- has no place in a good flight instruction program.
3- may completely subdue and destroy the initiative of a timid student.
4- will cause reactions which the good instructor can utilize to determine if the student is highly motivated.

TEST ITEM 7. Lesson plans or course syllabuses should be

1- followed exactly if maximum benefit is to be derived from their use.
2- adapted to the learning situation and changed when necessary.
3- used primarily by inexperienced instructors.
4- used primarily by those instructors who must teach students who have already received part of their flight training from another instructor.

TEST ITEM 8. The responsibilities of today's flight instructor are very real and very complex. The instructor can best live up to these responsibilities by

1- requiring a high standard of proficiency in his students.
2- establishing his effectiveness as an instructor on the basis of an objective evaluation of his own flying proficiency.
3- discouraging from further instruction those students who do not have a natural physical and mental capacity to fly.
4- a keen analysis of his students and a deep personal interest in their welfare.

TEST ITEM 9. Listed below are four statements. Which of these statements most accurately describe the terms "perceptions" and "insights"?

A. Bits of information (sights and sounds).

B. Receipt of bits of information.

C. Giving meaning to bits of information.

D. Grouping of meanings given to bits of information into meaningful wholes.

1- Perceptions - A; insights - C.
2- Perceptions - B; insights - C.
3- Perceptions - C; insights - D.
4- Perceptions - D; insights - C.

TEST ITEM 10. In what way is a negative self-concept likely to affect a student? A negative self-concept may introduce psychological factors which

1- can affect unfavorably a student's ability to receive perceptions and inhibit his ability to perform after perceiving.
2- can affect unfavorably a student's ability to receive perceptions but, once he perceives, will have no affect on his ability to do or perform.
3- will have neligible affect on a student's ability to receive perceptions or on his ability to perform.
4- will result in a student being less "on the defensive."

SECTION 2. PERFORMANCE AND ANALYSIS OF FLIGHT TRAINING MANEUVERS

TEST ITEM 11. In explaining the terms "high density altitude" and "low density altitude" to your students, you should emphasize that the term "low density altitude" conditions refers to those conditions that result in

1- thin air and improved performance.
2- thin air and reduced performance.
3- dense air and improved performance.
4- dense air and reduced performance.

TEST ITEM 12. A jump takeoff would most likely be used for which of the following type takeoffs?

1- Crosswind takeoff.
2- Short field takeoff.
3- Soft field takeoff.
4- Takeoff under high "density altitude" conditions.

TEST ITEM 13. Longitudinal and lateral control in a gyroplane in flight are effected by

1- rudder control.
2- tilting the plane of rotation of the rotor in the direction that control is desired.
3- adjusting the pitch of the rotor blades in the direction that control is desired.
4- increasing or decreasing the speed of the rotor rotation as necessary for desired control.

TEST ITEM 14. In which of the following situations would the rotor RPM be the least in a gyroplane?

1- Immediately after takeoff.
2- A vertical descent with zero airspeed.
3- Pushing over the top of a steep pull-up.
4- During a power-off descent with low airspeed.

TEST ITEM 15. Which of the following will cause a decrease in coning?

1- Decrease in lift; decrease in centrifugal force.
2- Increase in lift; increase in centrifugal force.
3- Decrease in lift; increase in centrifugal force.
4- Increase in lift; decrease in centrifugal force.

TEST ITEM 16. The forward speed (V_{ne} - Never-exceed speed) of a gyroplane is limited by

1- solidity ratio.
2- lateral controllability or retreating blade stall.
3- centrifugal twisting moment of the rotor blades.
4- available horsepower of the engine which may be converted to torque.

TEST ITEM 17. During flight, if you apply cyclic control pressure which results in a maximum increase in pitch angle of the rotor blades at position "A," the rotor disc will tilt

1- left.
2- right.
3- aft.
4- forward.

(Refer to top illustration on page 20, Appendix 3)

TEST ITEM 18. While on a dual instructional flight at cruising power and airspeed in level flight, you call your student's attention to the rotor RPM. You then advise him that on solo flights, while in level flight under the same conditions (except for the reduced weight due to the absence of the instructor), he can expect the rotor RPM to be

1- less since less lift is required due to the decrease in weight.
2- greater since the rotor blades will be operating at a smaller angle of attack and therefore create less drag.
3- greater since the center of gravity will be farther forward.
4- greater since the airspeed will be higher at the same power setting.

TEST ITEM 19. As the cyclic stick is moved to the right, the decrease in angle of attack of the rotor blades is greatest in position (refer to top illustration on page 20, Appendix 3)

1- D and the increase in angle of attack is greatest in position B.
2- B and the increase in angle of attack is greatest in position D.
3- C and the increase in angle of attack is greatest in position A.
4- A and the increase in angle of attack is greatest in position C.

TEST ITEM 20. Between which of the following two points will the gyroplane turn the greatest number of degrees?

1- 8 and 6.
2- 4 and 2.
3- 6 and 4.
4- 2 and 8.

(Refer to illustration on page 21, Appendix 3)

SECTION 3. ANSWERS AND EXPLANATIONS TO SAMPLE EXAMINATION TEST ITEMS

TEST ITEM 1 (Ans. 3). The Flight Instructor's Handbook, AC 61-16, states, "Negative motivations. . . are not characteristically as effective in promoting efficient learning as are positive motivations."

TEST ITEM 2 (Ans. 2). The Flight Instructor's Handbook, AC 61-16, states, "Worries and emotional upsets which result from the course at hand can be remedied. Such occurrences are usually evidence of inadequacies on the part of the course or of the instructor concerned."

TEST ITEM 3 (Ans. 1). The Flight Instructor's Handbook, AC 61-16, states, "The flight instructor's first step in teaching is to gain the student's confidence."

TEST ITEM 4 (Ans. 3). The Flight Instructor's Handbook, AC 61-16, states, "A student whose slow progress is found to be due to lack of confidence should be assigned subgoals which can be achieved easily."

TEST ITEM 5 (Ans. 3). The Flight Instructor's Handbook, AC 61-16, states, "Temporary random plateaus in the learning rate are not necessarily serious, and can be expected with any student. . . . .Slumps or plateaus in the rate of learning are more likely to occur as a student advances to more complicated operations. . . . ."

TEST ITEM 6 (Ans. 3). The Flight Instructor's Handbook, AC 61-16, states, "Too much criticism of his flight performance may completely subdue a timid person."

TEST ITEM 7 (Ans. 2). The Flight Instructor's Handbook, AC 61-16, states, "Any practical flight training syllabus must be flexible, and should be used primarily as a guide. The order of training can and should be altered, when necessary, to suit the progress of the student and the exigencies of special circumstances."

TEST ITEM 8 (Ans. 4). The Flight Instructor's Handbook, AC 61-16, states, "Only by a keen analysis of his students, and a continuing deep interest in them, can he live up to his responsibilities and be an effective flight instructor."

TEST ITEM 9 (Ans. 3). The Flight Instructor's Handbook, AC 61-16, states, "Perceiving involves more than the receipt of sights and sounds. Perceptions result when a person gives meaning to the sights and sounds which come his way. . . . .Insights involve the grouping of perceptions into meaningful wholes. . . . .This mental relating and grouping of associated perceptions is called insight."

TEST ITEM 10 (Ans. 1). The Flight Instructor's Handbook, AC 61-16, states, "Negative self concepts inhibit the perceptual processes by introducing psychological barriers which tend to keep the student from receiving them and then perceiving what the instructor intends. They may even inhibit the ability to properly implement that which is perceived. That is, they affect unfavorably the "ability to do." Learners who view themselves positively, on the other hand, are less defensive. . . . ."

TEST ITEM 11 (Ans. 3). The Basic Helicopter Handbook, AC 61-13, states, ". . .those conditions that result in dense air--low elevations, low temperatures, low moisture content, or some combination thereof--would be referred to as low density altitude conditions. . . . .The most favorable conditions for performance are the combination of a low-density altitude, light gross weight. . . ."

TEST ITEM 12 (Ans. 3). The "Jump Take Off" Performance Chart (Appendix 3, Page 8) shows that above a certain pressure altitude/temperature combination (density altitude), a running takeoff should be used. A jump takeoff could be used during crosswind conditions or for a short field takeoff; however, a greater distance is required to clear 50-foot obstacles for a jump takeoff than for a running takeoff. A jump takeoff may be required on a soft field to prevent the gyroplane from sinking into the soft ground during a ground roll.

TEST ITEM 13 (Ans. 2). Longitudinal and lateral control in a gyroplane are effected by tilting the plane of rotation of the rotor in the direction that control is desired. This is accomplished by moving the cyclic stick in the direction that control is desired. The explanation for TEST ITEM 19 will explain why response no. 3 is incorrect. Response no. 4 is incorrect because the pilot has no control over the speed of rotor rotation in flight.

TEST ITEM 14 (Ans. 3). One FAA-approved Gyroplane Flight Manual states, "Excessive use of cyclic control when rotor RPM falls below 200 RPM (obtained by pushing over top of a steep pull up) may result in excessive flapping of rotor blades."

TEST ITEM 15 (Ans. 3). The Basic Helicopter Handbook, AC 61-13, states, "Coning is the upward bending of the blades caused by the combined forces of lift and centrifugal force. . . . .centrifugal force acting outward. . . . .and lift acting upward. . . ." Therefore, when lift is decreased or centrifugal force is increased, coning will decrease.

TEST ITEM 16 (Ans. 2). The Basic Helicopter Handbook, AC 61-13, states, ". . . .for any given angle of attack, lift increases as the velocity of the airflow over the airfoil increases. It is apparent that the lift over the advancing blade half of the rotor disc will be greater than the lift over the retreating blade half during horizontal flight. . . . . unless some compensation is made. It is equally apparent that the (gyroplane) will roll to the left unless some compensation is made. . . . . A tendency for the retreating blade to stall. . . .is a major factor in limiting. . . .airspeed. . . . . The stall of a rotor blade limits the high airspeed potential of a helicopter."

TEST ITEM 17 (Ans. 4). The Basic Helicopter Handbook, AC 61-13, states, "The spinning. . . .rotor. . . .acts like a gyroscope. As such, it has the properties of gyroscopic action, one of which is precession. Gyroscopic precession is the resultant action or deflection of a spinning object when a force is applied to this object. This action occurs approximately 90° in the direction of rotation from the point where the force is applied. Through the use of this principle, the tip-path plane of the. . . .rotor may be tilted from the horizontal."

TEST ITEM 18 (Ans. 1). One FAA-approved Gyroplane Flight Manual states, "A rotor RPM variance will be noted between light weight and maximum weight. This is a function of lift required and normal for this aircraft."

TEST ITEM 19 (Ans. 1). The Basic Helicopter Handbook, AC 61-13, states, ". . . .as the cyclic stick is displaced forward, the angle of attack is decreased as the rotor blades pass the 90° position to the pilot's right (C in the illustration) and is increased as the blades pass the 90° position to the pilot's left (A in the illustration). Because of gyroscopic precession, maximum downward deflection of the rotor blades is forward and maximum upward deflection is aft, causing the rotor disc to tilt forward in the same direction as cyclic stick displacement. A similar analysis could be made for any direction of displacement of the cyclic stick." A similar analysis for a right displacement of the cyclic stick gives the greatest decrease in angle of attack at D and the greatest increase at B.

TEST ITEM 20 (Ans. 2). The Basic Helicopter Handbook, AC 61-13, states, "In addition to varying the angle of bank to correct for drift in order to maintain the proper radius of turn, the gyroplane must also be flown with a drift correction angle (crab) in relation to its ground track, except, of course, when it is on direct upwind or downwind headings or there is no wind. One would normally think of the fore and aft axis of the gyroplane as being tangent to the ground track pattern at each point. However, this is not the case. During the turn on the upwind side of the reference line (side from which the wind is blowing), the nose of the gyroplane will be crabbed toward the outside of the circle. During the turn on the downwind side of the reference line (side of the reference line opposite to the direction from which the wind is blowing), the nose of the gyroplane will be crabbed toward the inside of the circle. In either case, it is obvious that the gyroplane is being crabbed into the wind just as it is when trying to maintain a straight ground track. The amount of crab depends upon the wind velocity and how nearly the gyroplane is to a crosswind position. The stronger the wind, the greater the crab angle at any given position for a turn of a given radius. The more nearly the gyroplane is to a crosswind position, the greater the crab angle." By noting the amount and direction of crab in the illustration (Appendix 3, page 21), you should easily see that the gyroplane must turn the greatest number of degrees between positions 4 and 2.

(NOTE: In quotes taken from the Basic Helicopter Handbook, the word "helicopter" has been replaced with "gyroplane" in most places.)

APPENDIX 3. SUPPLEMENTAL MATERIALS

All of the charts, illustrations and other selected materials presented in Appendix 3 are of value to the student preparing for the examination for the Flight Instructor Certificate. Users of this Guide should not assume that the questions appearing in the sample examination make full use of the material in this Appendix. This would seriously limit the benefits to be derived from the material. Every chart or illustration can be related to topics covered in the Study Outline. Even more important is the fact that every chart or illustration is either directly or indirectly related to the charts, illustrations and test items that may appear in the actual examination. Study all of them.

SECTION 1. GYROPLANE FLIGHT MANUAL EXCERPTS OPERATING LIMITATIONS

COMPLIANCE WITH SECTION 1 OF THIS MANUAL IS MANDATORY.

Weight Limitations:

1. Maximum approved gross weight, 1,800 pounds.

Airspeed Limitations:

NOTE: ALL AIRSPEED VALUES GIVEN THROUGHOUT THIS MANUAL ARE FOR CALIBRATED AIRSPEED (CAS)

Weight in Lbs.	1,800	1,600
V_{ne}	97 mph	84 mph

MANEUVERING AIRSPEED - V_p - 68 mph CAS.

MAXIMUM ALTITUDE APPROVED FOR TAKEOFF IS 4,000 FT. DENSITY.

Rotor Limitations:

1. Maximum 370 rpm on ground.

2. Maximum rotor brake engagement rpm - 75.

3. Rotor rpm for flight: Minimum 200; Maximum - 320.

Power Plant Limitations - Lycoming Engine O-360-AID.

1. Fuel octane 100 minimum.

2. Idling rpm 600 to 700.

3. Start clutch engagement - 900-1100 rpm.

4. Maximum operating rpm - 2700.

5. Maximum manifold pressure zero ram - 28.5 inches at 2700.

6. Ground run-up at 1900 rpm and 28.5 inches limited to 2 minutes.

7. Oil pressure, min. at idling 25 psi. Oil pressure max. operating 85 psi.

8. Cylinder head temperature max. 500°F (260°C).

9. Oil temperature - max. 245°F (118°C).

Flight Crew:

1. Minimum crew required is one pilot.

   This rotorcraft is approved for day or night VFR flights only. Night flying operations are limited to visual contact flight conditions. Orientation must be maintained through visual reference to ground objects as a result of lights on the ground or adequate celestial illumination.

Placards:

1. This gyroplane must be operated in compliance with the operating limitations specified in the FAA-approved Rotorcraft Flight Manual.

2. No aerobatic maneuvers are permitted.

3.

WEIGHT-LBS.	1,800	1,600
V_{ne}	97	84

4. Avoid continuous operation between 2250 - 2500 rpm.

5. Do not engage rotor brake above 75 rpm.

6. Start clutch engagements 900-1100 rpm.

7. Maximum altitude approved for takeoff is 4,000 feet density.

SECTION 2. GYROPLANE FLIGHT MANUAL EXCERPTS NORMAL OPERATING PROCEDURES

Servicing:

Fuel Minimum Octane 100. Tank capacity 28.4 gallons.
Unusable fuel 1.3 gallons
Oil Aviation Grade — Above 40°F SAE 50
Below 40°F SAE 30
Below 10°F SAE 20

Taxiing:

NOTE: ALWAYS TAXI WITH THE BLADES IN DEPITCHED POSITION, LIMIT TAXIING SPEED TO 5 MPH OVER ROUGH GROUND.

Engine Run-up:

NOTE: DO NOT ATTEMPT TO MAKE A FULL POWER RUN-UP WITH A DIRECT LEFT CROSSWIND IN EXCESS OF 15 MPH (13 KNOTS).

Clutch Engagement:

NOTE: ALL TAKEOFFS MUST BE MADE BY PREROTATING THE ROTOR.

NOTE: 1100 ENGINE RPM IS THE ABSOLUTE MAXIMUM ALLOWABLE FOR CLUTCH ENGAGEMENT.

NOTE: TO PREVENT MAIN ROTOR BLADES FROM POUNDING DROOP STOPS AND CAUSING UNNECESSARY STRAIN AND ROUGHNESS, MAINTAIN NEUTRAL STICK POSITION ON THE GROUND WITH BLADES ROTATING.

CAUTION: INTERRUPTION OR FAILURE OF ELECTRICAL OR HYDRAULIC SYSTEM WILL RESULT IN THE ROTOR BLADES GOING INTO FLIGHT PITCH.

NOTE: MODERATE PITCHING AND ROLLING MOTIONS MAY BE EXPERIENCED IN AIRCRAFT BETWEEN 80 AND 130 ROTOR RPM DUE TO ROTOR BLADES BEING OUT OF PATTERN WHILE PASSING THROUGH THIS ROTOR RPM RANGE. IF THIS SHOULD BECOME EXAGGERATED, CLOSE THROTTLE, PRESS DEPITCH (DECLUTCH) BUTTON ON PANEL.

CAUTION: MAXIMUM ALLOWABLE MANIFOLD PRESSURE 28.5 IN. DO NOT EXCEED TWO MINUTES DURATION.

NOTE: FOR IMMEDIATE OR EMERGENCY STOP, CLOSE THROTTLE FULLY, PRESS DEPITCH BUTTON ON PANEL.

Running Takeoff Procedure (normal) - Smooth Terrain:

NOTE: THIS AIRCRAFT WILL NOT TAKE OFF WITH A ROTOR RPM OF LESS THAN 200.

Cruise:

CAUTION: AVOID CONTINUOUS OPERATION BETWEEN 2250 AND 2500 RPM.

For 65% power, 2250 RPM and 22.3" Hg.
For 65% power, 2500 RPM and 21.3" Hg.
For 75% power, 2250 RPM and 24.8" Hg.
For 75% power, 2500 RPM and 23.6" Hg.

NOTE: A ROTOR RPM VARIANCE WILL BE NOTED BETWEEN LIGHT WEIGHT AND MAXIMUM WEIGHT. THIS IS A FUNCTION OF LIFT REQUIRED AND NORMAL FOR THIS AIRCRAFT.

NOTE: IN-FLIGHT-EXCESSIVE USE OF CYCLIC CONTROL WHEN ROTOR RPM FALLS BELOW 200 RPM (OBTAINED BY PUSHING OVER TOP OF A STEEP PULL-UP) MAY RESULT IN EXCESSIVE FLAPPING OF ROTOR BLADES.

NOTE: TURBULENT AIR - IN EXTREME TURBULENCE IT IS RECOMMENDED THAT AIRSPEED BE REDUCED APPROPRIATELY.

Landing:

NOTE: AN AIRSPEED OF LESS THAN 50 MAY BE USED ABOVE 300 FEET ABOVE GROUND. BELOW 300 FEET 50 MPH OR MORE SHOULD BE MAINTAINED DEPENDING UPON ATMOSPHERIC CONDITIONS AND LANDING WEIGHT.

Crosswind Landing:

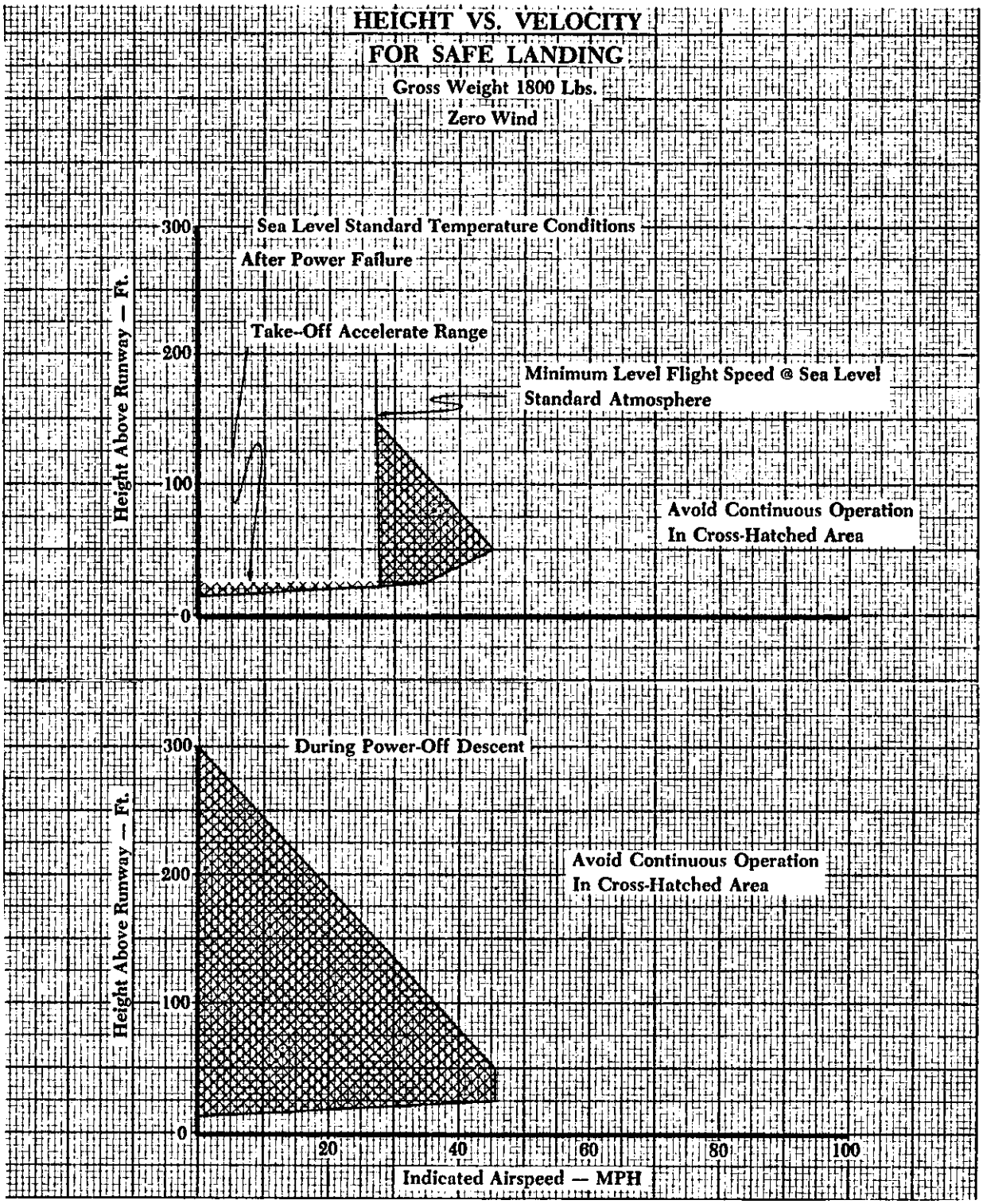
NOTE: THIS ROTORCRAFT HAS DEMONSTRATED SATISFACTORY LANDING AND TAKEOFF CHARACTERISTICS IN 90° CROSSWINDS UP TO 20 MPH.

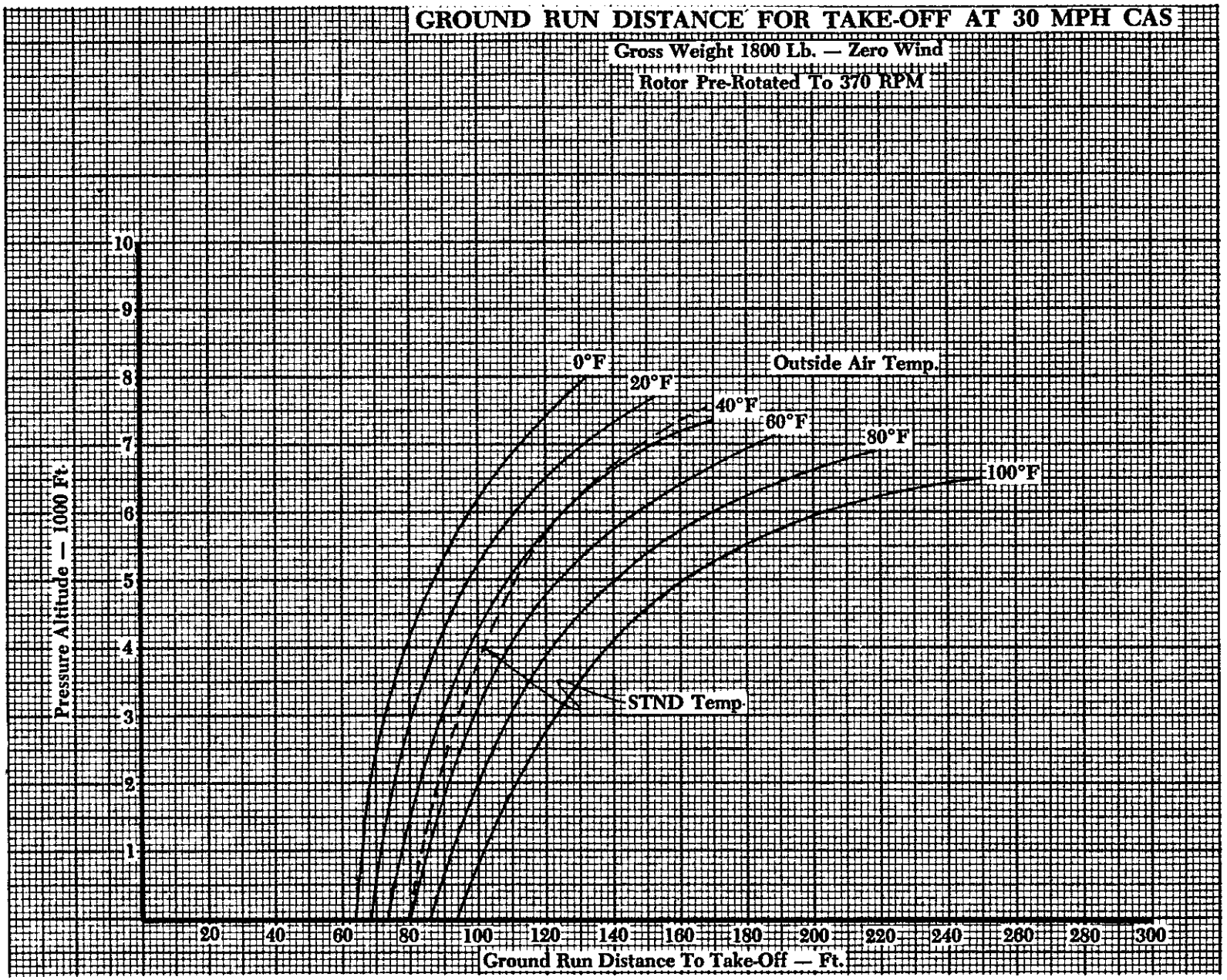
Touchdown Speed:

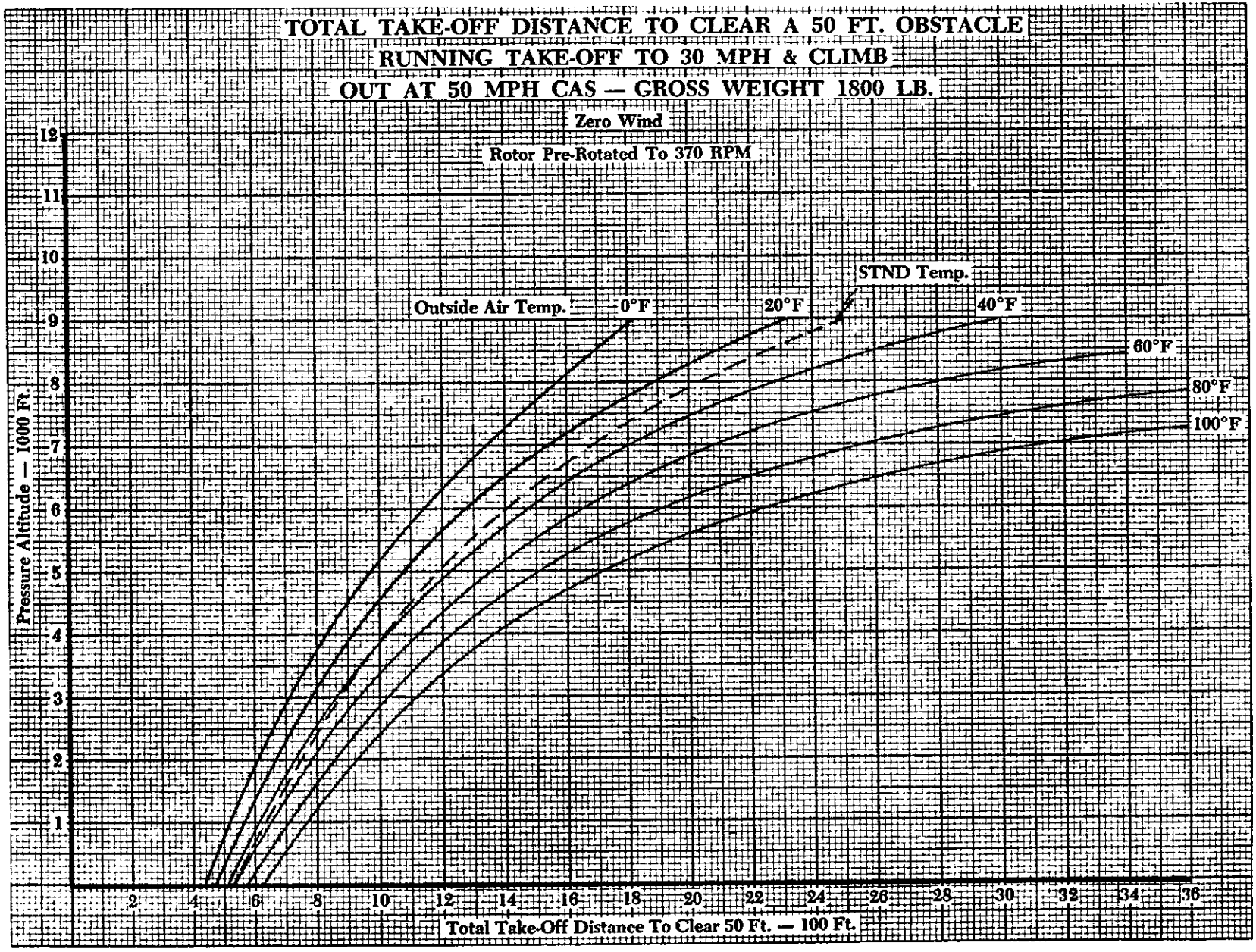
NOTE: TOUCHDOWN SPEEDS UP TO 65 MPH TAS HAVE BEEN DEMONSTRATED TO BE SAFE.

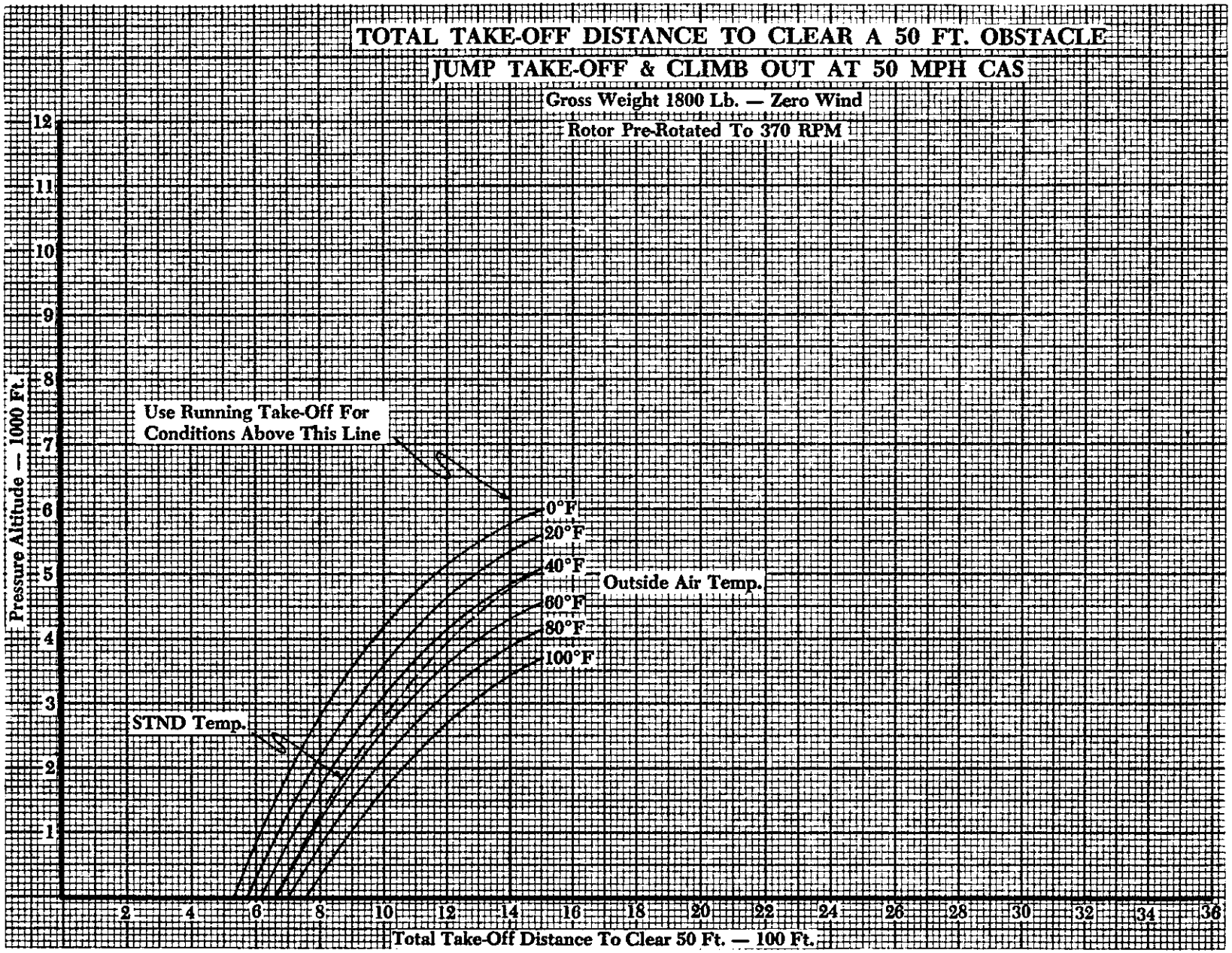
MINIMUM LEVEL FLIGHT SPEED - 27 MPH.

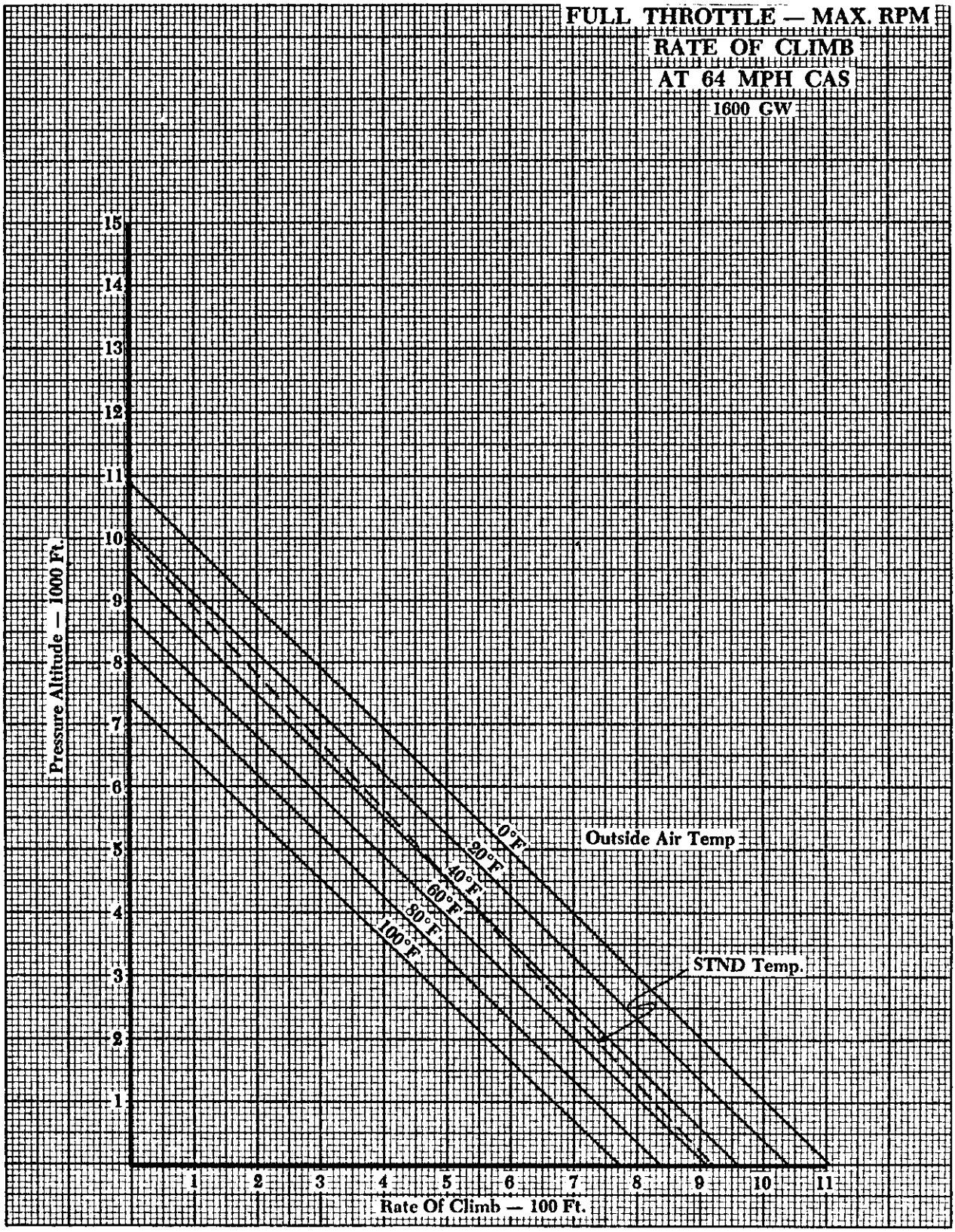
SECTION 3. GYROPLANE FLIGHT MANUAL EXCERPTS
PERFORMANCE AND OTHER CHARTS

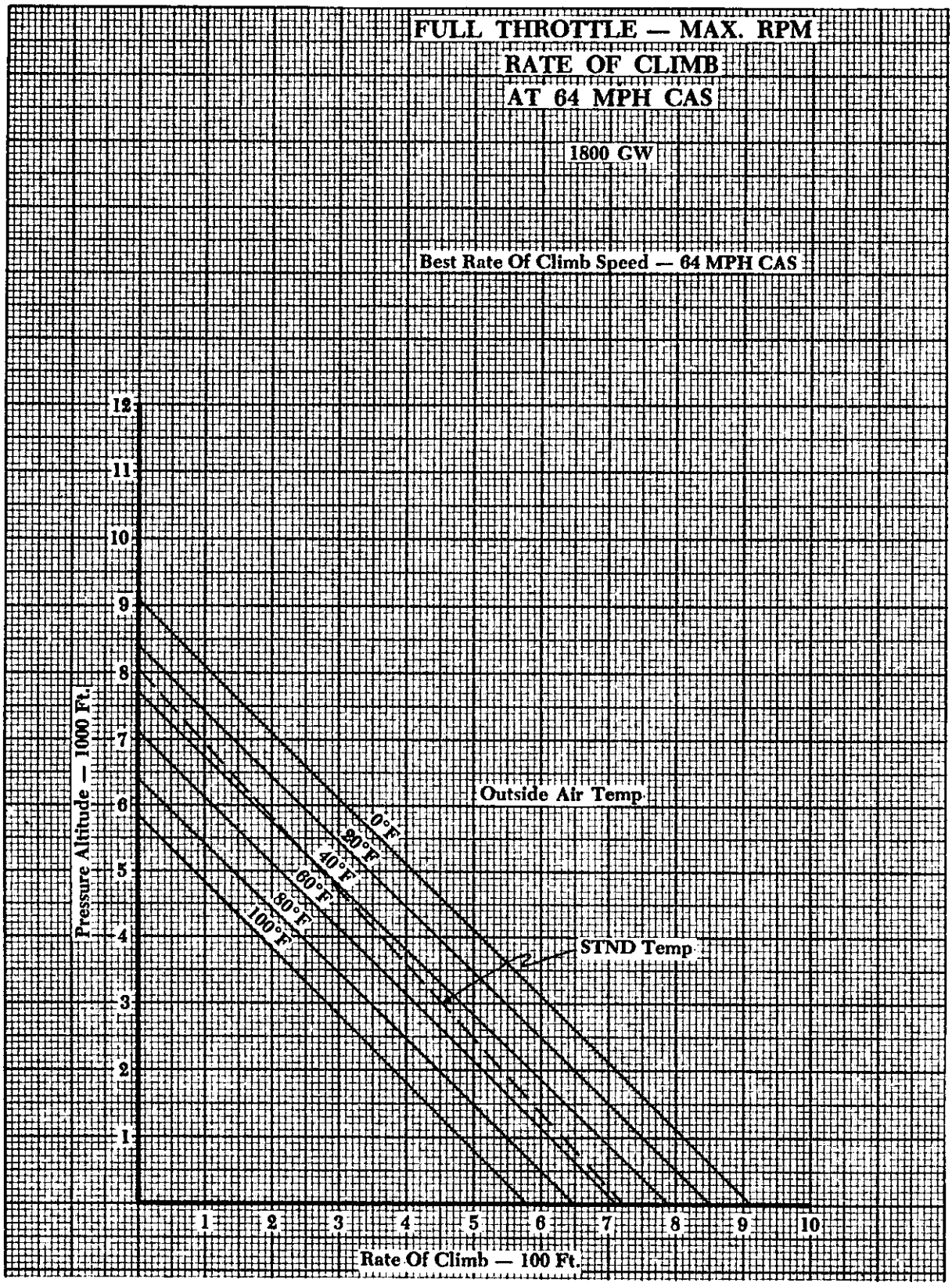


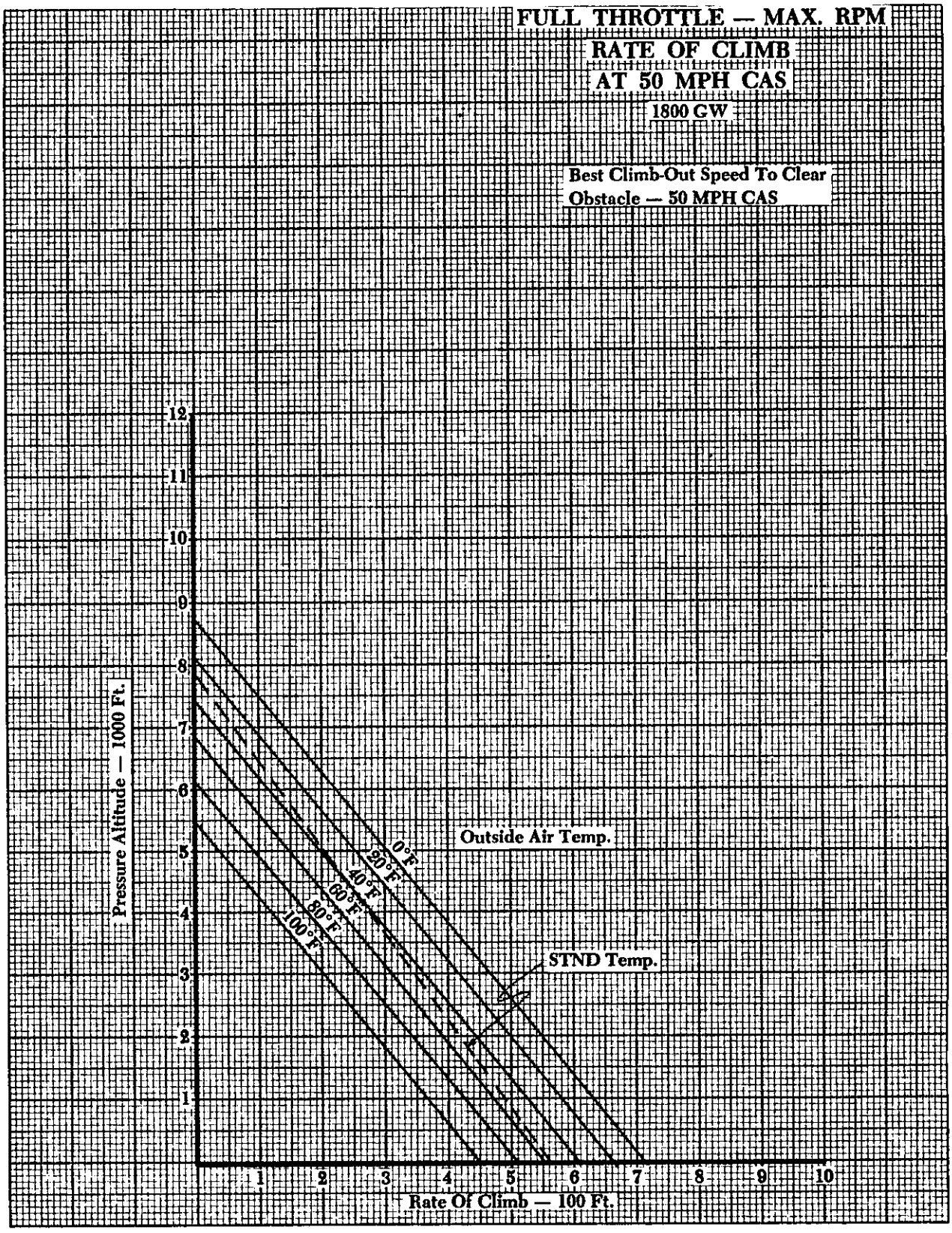

GROUND RUN DISTANCE FOR TAKE-OFF AT 30 MPH CAS
Gross Weight 1800 Lb. — Zero Wind
Rotor Pre-Rotated To 370 RPM
Pressure Altitude — 1000 Ft.
10
9
8
7
6
5
4
3
2
1
0°F
20°F
40°F
60°F
80°F
100°F
Outside Air Temp.
STND Temp
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
Ground Run Distance To Take-Off — Ft.

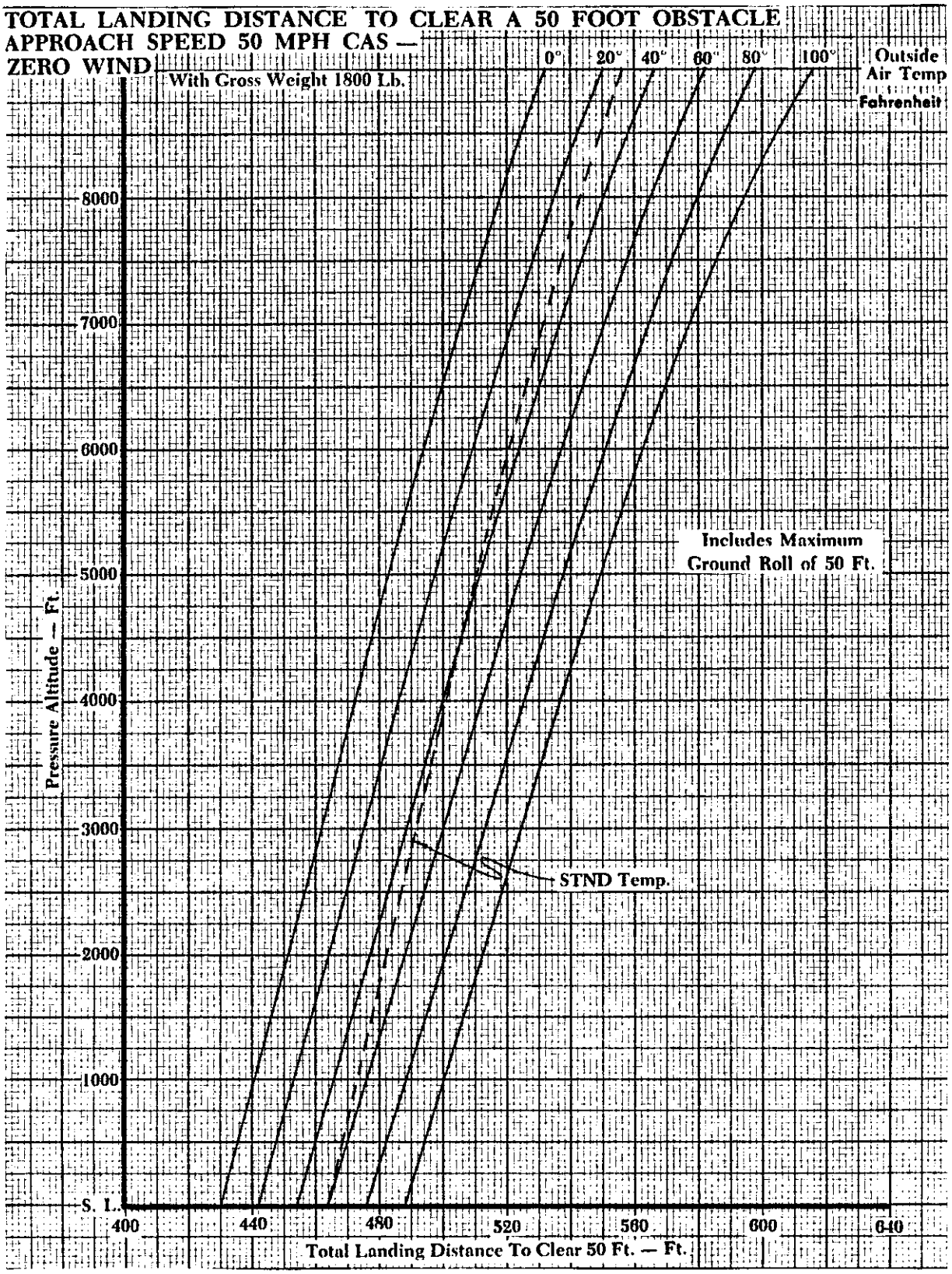

TOTAL TAKE-OFF DISTANCE TO CLEAR A 50 FT. OBSTACLE
RUNNING TAKE-OFF TO 30 MPH & CLIMB
OUT AT 50 MPH CAS — GROSS WEIGHT 1800 LB.
Zero Wind
Rotor Pre-Rotated To 370 RPM
Outside Air Temp.
0°F
20°F
STND Temp.
40°F
60°F
80°F
100°F
Pressure Altitude — 1000 Ft.
12
11
10
9
8
7
6
5
4
3
2
1
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
Total Take-Off Distance To Clear 50 Ft. — 100 Ft.

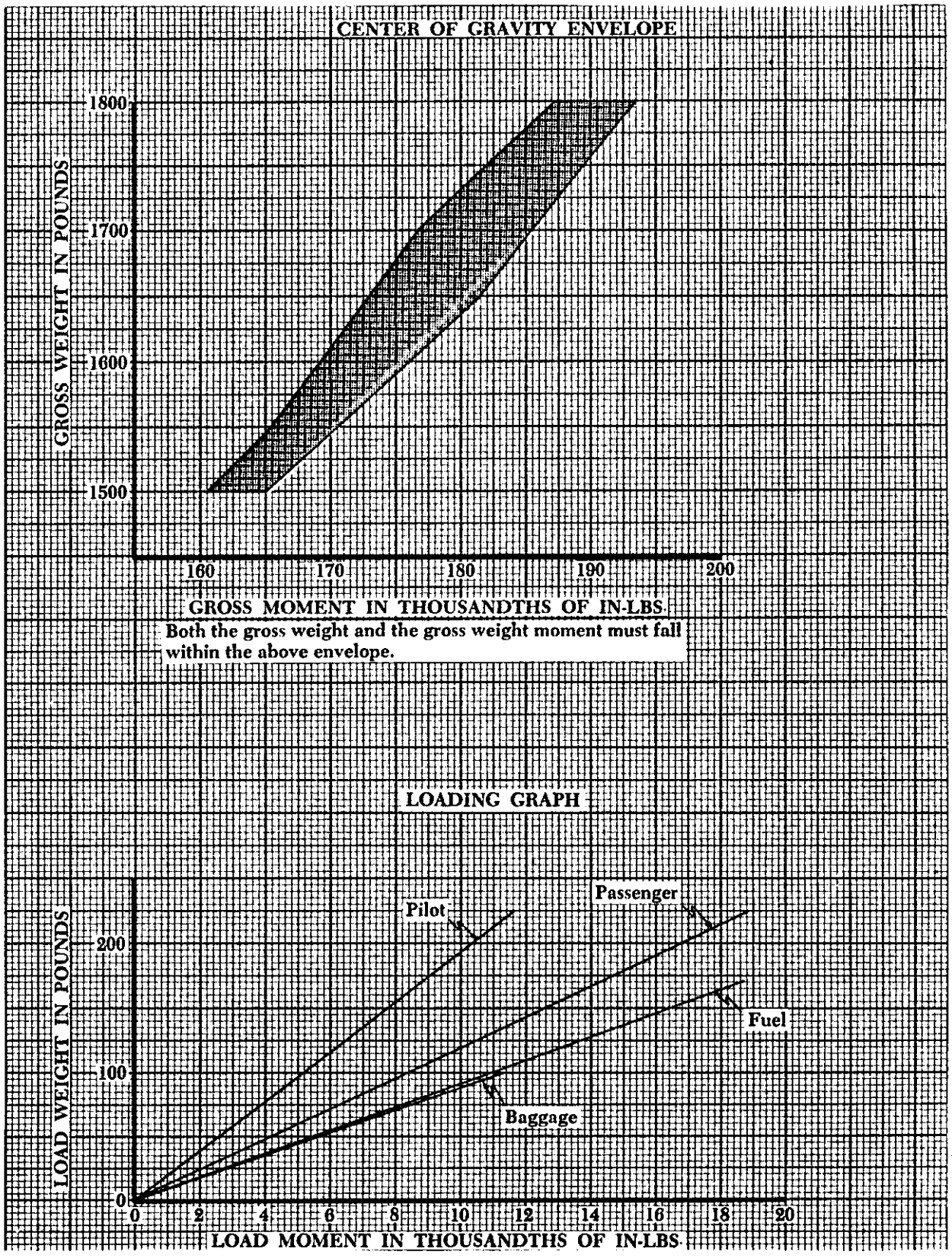

TOTAL TAKE-OFF DISTANCE TO CLEAR A 50 FT. OBSTACLE
JUMP TAKE-OFF & CLIMB OUT AT 50 MPH CAS
Gross Weight 1800 Lb. — Zero Wind
Rotor Pre-Rotated To 370 RPM
Pressure Altitude — 1000 Ft.
12
11
10
9
8
7
6
5
4
3
2
1
Use Running Take-Off For Conditions Above This Line
0°F
20°F
40°F
60°F
80°F
100°F
Outside Air Temp.
STND Temp.
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
Total Take-Off Distance To Clear 50 Ft. — 100 Ft.


FULL THROTTLE — MAX. RPM
RATE OF CLIMB
AT 64 MPH CAS
1600 GW
Pressure Altitude — 1000 Ft.
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0°F
20°F
40°F
60°F
80°F
100°F
Outside Air Temp
STND Temp.
1
2
3
4
5
6
7
8
9
10
11
Rate Of Climb — 100 Ft.


FULL THROTTLE — MAX. RPM
RATE OF CLIMB
AT 64 MPH CAS
1800 GW
Best Rate Of Climb Speed — 64 MPH CAS
Pressure Altitude — 1000 Ft.
12
11
10
9
8
7
6
5
4
3
2
1
Outside Air Temp
0°F
20°F
40°F
60°F
80°F
100°F
STND Temp
1
2
3
4
5
6
7
8
9
10
Rate Of Climb — 100 Ft.


FULL THROTTLE — MAX. RPM
RATE OF CLIMB
AT 50 MPH CAS
1800 GW
Best Climb-Out Speed To Clear Obstacle — 50 MPH CAS
Pressure Altitude — 1000 Ft.
12
11
10
0
8
7
6
5
4
3
2
1
Outside Air Temp.
0°F.
20°F.
40°F.
60°F.
80°F.
100°F.
STND Temp.
1
2
3
4
5
6
7
8
9
10
Rate Of Climb — 100 Ft.


TOTAL LANDING DISTANCE TO CLEAR A 50 FOOT OBSTACLE
APPROACH SPEED 50 MPH CAS —
ZERO WIND
With Gross Weight 1800 Lb.
0°
20°
40°
60°
80°
100°
Outside Air Temp Fahrenheit
8000
7000
6000
5000
4000
3000
2000
1000
S. L.
Pressure Altitude — Ft.
Includes Maximum Ground Roll of 50 Ft.
STND Temp.
400
440
480
520
560
600
640
Total Landing Distance To Clear 50 Ft. — Ft.


CENTER OF GRAVITY ENVELOPE
GROSS WEIGHT IN POUNDS
1800
1700
1600
1500
160
170
180
190
200
GROSS MOMENT IN THOUSANDTHS OF IN-LBS
Both the gross weight and the gross weight moment must fall within the above envelope.
LOADING GRAPH
LOAD WEIGHT IN POUNDS
200
100
0
Pilot
Passenger
Fuel
Baggage
0
2
4
6
8
10
12
14
16
18
20
LOAD MOMENT IN THOUSANDTHS OF IN-LBS

SECTION 4. AIRMAN'S INFORMATION MANUAL EXCERPTS

AIRPORT/FACILITY DIRECTORY LEGEND

LOCATION

The airport location is given in nautical miles (to the nearest mile) and direction from center of referenced city.

ELEVATION

Elevation is given in feet above mean sea level and is based on highest usable portion of the landing area. When elevation is sea level, elevation will be indicated as "00." When elevation is below sea level, a minus sign (−) will precede the figure.

RUNWAYS

The runway surface, length, reciprocal headings, and weight bearing capacity are listed for the longest instrument runway or sealane, or the longest active landing portion of the runway or strip, given to the nearest hundred feet, using 70 feet as the division point, i.e., 1468 feet would be shown as "14"; 1474 feet would be shown as "15." Runway lengths prefixed by the letter "H" indicates that runways are hard surfaced (concrete; asphalt; bitumen, or macadam with a seal coat). If the runway length is not prefixed, the surface is sod, clay, etc. The total number of runways available is shown in parenthesis. (However, only hard surfaced runways are counted at airfields with both hard surfaced and sod runways.)

RUNWAY WEIGHT BEARING CAPACITY

Add 000 to figure following S, T, TT and MAX for gross weight capacity, e.g., (S-000).

S–Runway weight bearing capacity for aircraft with single-wheel type landing gear. (DC-3), etc.

T–Runway weight bearing capacity for aircraft with twin-wheel type landing gear. (DC-6), etc.

TT–Runway weight bearing capacity for aircraft with twin-tandem type landing gear. (707), etc.

Quadricycle and twin-tandem are considered virtually equal for runway weight bearing considerations, as are single-tandem and twin-wheel.

A blank space following the letter designation is used to indicate the runway weight bearing capacity to sustain aircraft with the same type landing gear, although definite figures are not available, e.g., (T-).

MAX–Maximum runway gross weight bearing capacity for all aircraft.

Omission of weight bearing capacity indicates information unknown. Footnote remarks are used to indicate a runway with a weight bearing greater than the longest runway.

SEAPLANE BASE FACILITIES

A number preceding the parenthetical designation, indicates the number (quantity) available.

Beaching gear, consisting of the quantity and type of beaching gear available.

The number (quantity) if available, of Mooring Buoys (MB) and Crash Boats (CB) available. MB & CB indicates details of quantity are not available.

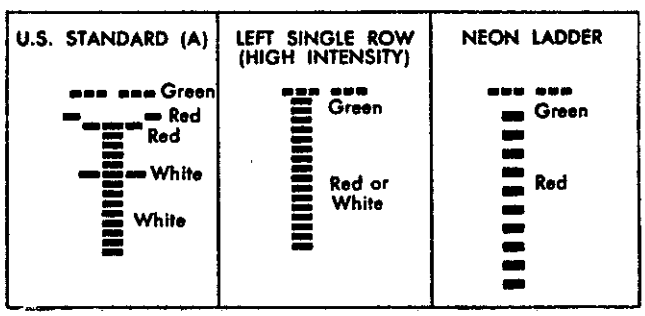
LIGHTING

B: Rotating Light (Rotating beacon). (Green and white, split-beam and other types.) Omission of **B** indicates rotating light is either not available or not operating standard hours (sunset-sunrise).

NOTE.—Code lights are not codified, and are carried in Remarks.

L: Field Lighting (when code **L4–7** is indicated, lighting **4, 5, 6, 7** is available). An asterisk (*) preceding an element indicates that it operates on prior request only (by phone call, telegram or letter). Where the asterisk is not shown, the lights are in operation or available sunset to sunrise or by request (circling the field or radio call). **L** by itself indicates temporary lighting, such as flares, smudge pots, lanterns.

1—Strip lights or portable runway lights (electrical)
2—Boundary
3—Runway Floods
4—Low Intensity Runway
5—Medium Intensity Runway
6—High Intensity Runway
7—Instrument Approach (neon)
8A, B, or C—High Intensity Instrument Approach



9—Sequence Flashing Lights (3,000' out unless otherwise stated)
10—Visual Approach Slope Indicator (VASI)
11—Runway end identification lights (threshold strobe) (REIL)
12—Short approach light systems (SALS)

Lighting (Con't)

13—Runway alignment lights (RAIL)
14—Runway centerline
15—Touchdown zone

Because the obstructions on virtually all lighted fields are lighted, obstruction lights have not been included in the codification.

SERVICING

S1: Storage.
S2: Storage, minor airframe repairs.
S3: Storage, minor airframe and minor powerplant repairs.
S4: Storage, major airframe and minor powerplant repairs.
S5: Storage, major airframe and major powerplant repairs.

FUEL

F1 80 oct., at least.
F2 80/87 oct., or lower.
F3 91/96 oct., or lower.
F4 100/130 performance rating, or lower.
F5 115/145 performance rating, or lower.

TURBINE FUELS

TP–1 650 turbine fuels for civil jets.
JP–1 (Kerosene), JP–3, JP–4, JP–5.

DAYLIGHT SAVING TIME

An airport located in a geographic area which normally converts to daylight saving time will be so identified by use of a code.

The two most common time periods during which daylight time is in effect in the conterminous United States are April 25–September 26 and April 25–October 31, and these are indicated as DT 1 and DT 2 respectively. The code "DT" by itself indicates that daylight time is in effect but not on the common time periods of DT 1 or DT 2. In such cases the applicable time period is footnoted in the airport remarks section.

Reference to daylight time will remain in the Airport Directory continuously.

OTHER

AOE—Airport of Entry.
VASI—Visual Approach Slope Indicator, applicable runway provided.
RVV—Runway visibility, applicable runway provided.
RVR—Runway Visual Range, applicable runway provided.
TPA—*Traffic Pattern Altitude—This information is provided only at those airports without a 24–hour operating control tower or without an FSS providing Airport Advisory Service. Directions of turns are indicated only when turns of the pattern(s) are to the right (non-standard). TPA data are related to the runway listed under the tabulated airport information. Generally, only one altitude is listed, however, at some airports two altitudes have been established; one for conventional aircraft and one for high performance aircraft. They are shown in this manner, TPA 8/15–R (increments of 100 feet). The higher figure being the higher performance aircraft altitude.*

FSS—The name of the controlling FSS is shown in all instances. When the FSS is located on the named airport, "on fld" is shown following the FSS name. When the FSS can be called through the local telephone exchange, (Foreign Exchange) at the cost of a local call, it is indicated by "(LC)" (local call) with the phone number immediately following the name of the FSS, i.e., "FSS: WICHITA (LC481–5867)." When an Intephone line exists between the field and the FSS, it is indicated by "(DL)" (direct line) immediately following the name of the FSS, i.e., "FSS: OTTO (DL)."

AIRPORT REMARKS

"FEE" indicates landing charges for private or non-revenue producing aircraft. In addition, fees may be charged for planes that remain over a couple of hours and buy no services, or at major airline terminals for all aircraft.

"Rgt tfc 13–31" indicates right turns should be made on landings and takeoffs on runways 13 and 31.

Remarks data is confined to operational items affecting the status and usability of the airport, traffic patterns and departure procedures.

Obstructions.—Because of space limitations only the more dangerous obstructions are indicated. Natural obstructions, such as trees, clearly discernible for *contact operations, are frequently omitted.* On the other hand, all pole lines within at least 15:1 glide angle are indicated.

COMMUNICATIONS

Clearance is required prior to taxiing on a runway, taking off, or landing at a tower controlled airport.

When operating at an airport where the control tower is operated by the U.S. Government, two-way radio communication is required unless otherwise authorized by the tower. (When the tower is operated by someone other than the U.S. Government, two-way radio communication is required if the aircraft has the necessary equipment.)

Frequencies transmit and receive unless specified as: T—Transmit only, R—Receive only, X—On request. Primary frequencies are listed first in each frequency grouping, i.e., VHF, LF. Emergency frequency 121.5 is available at all TOWER, APPROACH CONTROL and RADAR facilities, unless indicated otherwise by a cross-out: 121.5

Radar available is listed under "RADAR SERVICES" Radar beacons are indicated by "(BCN)" after "RADAR SERVICES", when available.

VOICE CALL

The voice call for contact with the traffic control services listed at each airport is the airport name followed by the call of the particular service desired, i.e., "LAGUARDIA TOWER." In these instances, only the

AIRPORT/FACILITY DIRECTORY

name of the service is listed. When the voice call of the facility is not the same as the airport name, the complete voice call is listed.

SERVICES AVAILABLE

(See ATC Operations and Procedures, Section II)

TOWER

Clearance Delivery (CLRNC DEL).
Approach Control (APP CON) Radar and Non-Radar.
Departure Control (DEP CON) Radar and Non-Radar.
VFR Advisory Service (VFR ADV) Non-Radar.
Traffic Information Service (TFC INFO) Radar.
Surveillance Radar Approach (ASR).
Precision Radar Approach (PAR).
Ground Control (GND CON).
VHF Direction Finding (VHF/DF).

RADIO NAVIGATION AIDS

Included in this section is a tabulation of all Air Navigation Radio Aids in the National Airspace System and those upon which the FAA has approved an instrument approach. Private or military Navigation Radio Aids not in the National Airspace System are not tabulated.

AUTOMATIC TERMINAL INFORMATION SERVICE (ATIS)

ATIS is continuous broadcast of recorded non-control information in selected areas of high activity. See Section III.

RADAR APPROACH PROCEDURE MINIMA

Weather minima for precision and surveillance radar approaches (PAR/ASR) specify only the lowest straight-in authorized for the approach.

FLIGHT SERVICE STATION (FSS)

Airport Advisory Service (AAS).
Flight Following Service.
Island, Mountain and Lake Reporting Service.

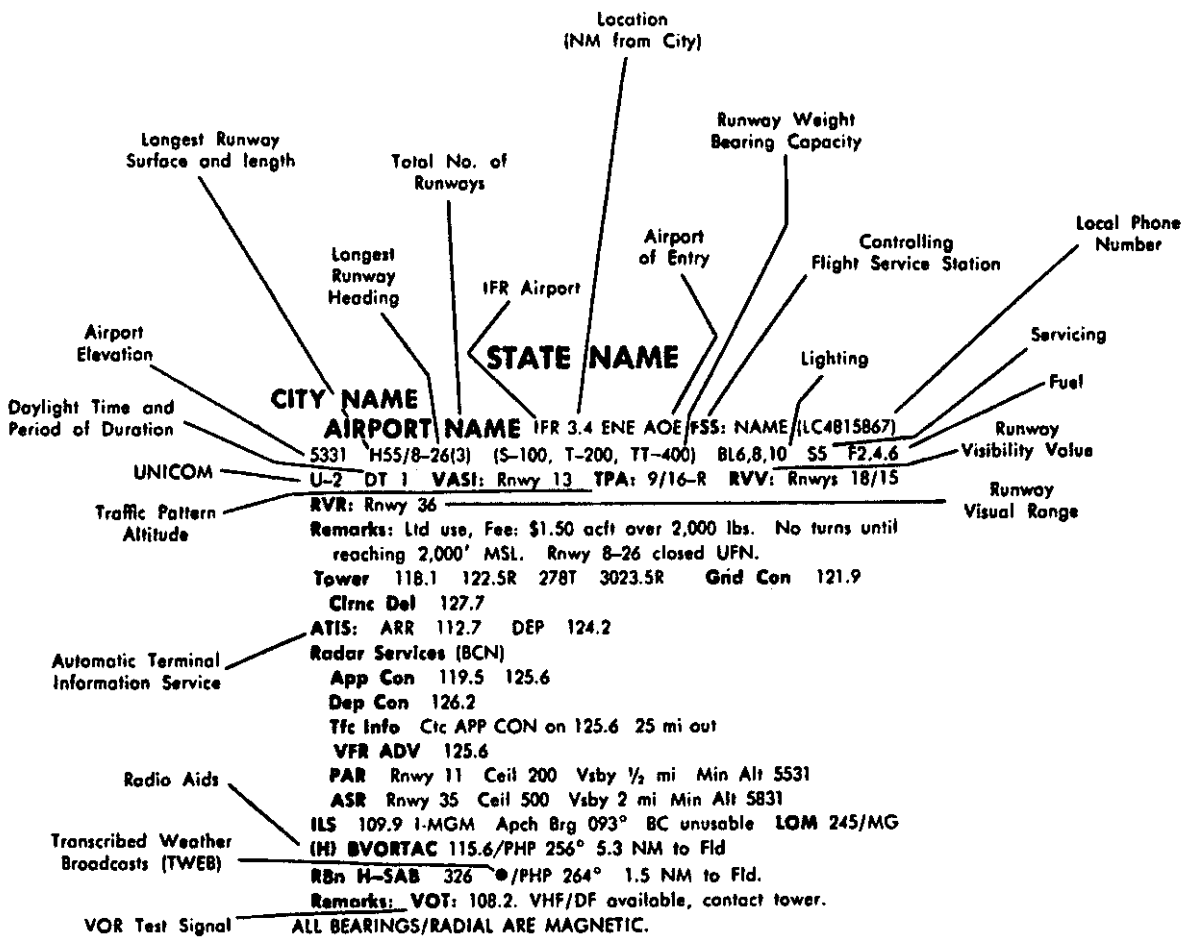
UNICOM

Private aeronautical station, operates same hours as the airport, transmits and receives on one of the following frequencies:

U-1—122.8 mc (at airports without a control tower).

U-2—123.0 mc (at airports with a control tower).

SAMPLE



RADIO CLASS DESIGNATIONS

Identification of VOR/VORTAC/TACAN Stations by Class (Operational Limitations):

Class	Normally Anticipated Altitude Service	Normally Anticipated Interference-Free Distance Service
H	Up to 45,000 MSL	149.75 smi (130 nmi)
	Above 45,000' MSL	115.2 smi (100 nmi)
L	Up to 18,000' MSL	46.06 smi (40 nmi)
T	Up to 12,000' MSL	28.79 smi (25 nmi)

H=High L=Low T=Terminal

NOTE: An H facility is capable of providing L and T service volume and an L facility additionally provides T service volume.

The term VOR is, operationally, a general term covering the VHF omnidirectional bearing type of facility without regard to the fact that the power, the frequency-protected service volume, the equipment configuration, and operational requirements may vary between facilities at different locations.

AB ---------- Continuous automatic transcribed broadcast service.

B ---------- Scheduled Broadcast Station (broadcasts weather at 15 and 45 minutes after the hour; Air Force Broadcasts, generally, 29 minutes).

DME ------- UHF standard (TACAN compatible) distance measuring equipment.

H ---------- Non-directional radio beacon (homing), power 50 watts to less than 2,000 watts.

HH --------- Non-directional radio beacon (homing), power 2,000 watts or more.

H-SAB ----- Non-directional radio beacons providing automatic transcribed weather service.

ILS --------- Instrument Landing System (voice on localizer channel).

LMM ------- Compass locator station when installed at middle marker site.

LOM ------- Compass locator station when installed at outer marker site.

MA --------- Range (adcock, vertical raditors), power less than 50 watts.

MH --------- Non-directional radio beacon (homing) power less than 50 watts.

ML --------- Range (loop radiators), power less than 50 watts.

MRA ------- Range (adcock, vertical radiators), power 50 watts or more but less than 150 watts.

MRL ------- Range (loop radiators), power 50 watts or more, but less than 150 watts.

RA --------- Range (adcock, vertical radiators), power 150 watts or more.

RBn -------- *Non-directional rdo bcn.*

RL --------- Range (loop radiators), power 150 watts or more.

S ---------- Simultaneous range, homing signal and/or voice.

SABH ------ Non-directional radio beacon having limited navigational use. Provides automatic weather broadcasts.

TACAN ----- UHF navigational facility—omnidirectional course and distance information.

VOR -------- VHF navigational facility—omnidirectional, course only.

VOR/DME -- Collocated VOR navigational facility and UHF standard distance measuring equipment.

VORTAC --- Collocated VOR and TACAN navigational facilities.

W ---------- Without voice facilities on range frequency.

Z ---------- VHF station location marker at a LF range station.

NOTES

1. All FAA MH facilities operate continuously unless otherwise cited.
2. All FAA ranges operate continuously. Those which are not manned continuously are cited in the remarks with hours of operation in parentheses, e.g., (0600-2400).
3. LMF and VHF ranges listed at the same location are controlled by the same FSS.
4. Military navigational facilities which are not part of the common system are not listed in this publication.

AIRPORT DIRECTORY

MISSOURI—*Continued*

COLUMBIA MUNI *IFR* 2 NW
778 H40 (2) BL4 S5 F4 FSS: COLUMBIA on Fld
Remarks: Shoulders soft. Rgt tfc pat on tk-off or ldg to S; other times left tfc pat. Taxi on rnwy when fld is wet.

CONSERVATION COMMISSION See EMINENCE

COUNTY See CHARLESTON

CREVE COEUR 5 NW
445 H16 (1) L4 S5 F4 FSS: ST LOUIS (DL)
Remarks: Rgt tfc SW. Rnwy lgts after midnight on prior req. 3236' strip avbl.

CUBA
FLUTTERBUGS ROOST ARPK 2 SE
990 H16 (1) F2 FSS: VICHY
Remarks: Ravine N. P-line S.

DEXTER MUNI 1 SE
304 H45 (2) BL4 S5 F4 U-1
FSS: CAPE GIRARDEAU
Remarks: Rgt tfc to N, NE. 30' unmrkd P-line E edge of fld.

DOWNTOWN See SPRINGFIELD

EADS See IBERIA

E KANSAS CITY See GRAIN VALLEY

EASTSIDE See ST JOSEPH

EDINA 4 SE
780 20 (3) F2 FSS: KIRKSVILLE
Remarks: P-line N.

EDWARDS RANCH See PINEVILLE

ELDON MODEL AIRPARK 1 NE
910 H23 (1) L4 F2 FSS: COLUMBIA
Remarks: P-line E, SW. Rgt tfc NE, W.

ELLINGTON
RAYFIELD 2 S
780 20 (1) FSS: VICHY

EMINENCE
CONSERVATION COMMISSION 3 NW
1080 20 (1) FSS: VICHY

EXCELSIOR SPRINGS MEML 1 SE
998 H20 (1) L4 S5 U1 FSS: KANSAS CITY
Remarks: Lgts oper dusk-midngt.

FAMULINER See GARDEN CITY

FARMINGTON MUNI 1 S
931 H24 (1) BL4 S5 F4 U-1
FSS: CAPE GIRARDEAU (DL)
Remarks: Rgt tfc rnwy 2, overrun each end.

FAYETTE-FLYING CLUB 2 S
680 28 (2)

FERRO'S RANCH-AERO See CLINTON

MISSOURI—*Continued*

FESTUS
LUCAS 1 S
435 23 (2) L4 S5 F4 FSS: ST LOUIS
Remarks: 4' fence crosses E end E/W rnwy.

FIELDS MEML See POPLAR BLUFF

FLUTTERBUGS ROOST ARPK See CUBA

FOWER See MACON

FREDERICKTOWN MUNI 3 N
870 H17 (1) L4 F2 FSS: CAPE GIRARDEAU

FRIEND ARPK See MONETT

FULTON MUNI 3 SW
875 H30 (1) BL4 S1 F4 U-1 FSS: COLUMBIA
Remarks: Poles SE.

GAINESVILLE MEML 2 NE
1060 21 (2) S1
Remarks: P-line SSW. TV ant N.

GARDEN CITY
FAMULINER 3 NW
898 22 (1) F2
Remarks: P-lines NE & SW.

GARST See WATSON

GIDEON MEML 1 SE
268 H45 (2) S4 F2 FSS: CAPE GIRARDEAU
Remarks: P-line N.

GLASGOW
HAWTHORN GLASGOW 1 W
600 28 (1)
Remarks: P-line N end rnwy. Soft when wet.

GOLDEN
BEL-VOIR ACRES 3 NE
1139 16 (1)
Remarks: P-line N.

TABLE ROCK 1 W
1060 H23 (1) F4

GORIN
PARRIS 1 S
760 19-(1) *L S3 F2 FSS: KIRKSVILLE
Remarks: Use at own risk.

WILEY'S AIRSTRIP 3 NW
662 19 (1) S5 F2 FSS: KIRKSVILLE

GRAIN VALLEY
E KANSAS CITY *IFR* Adj W
840 · H26 (2) L4 S5 F4 U-1 FSS: KANSAS CITY (DL)
VFR ADV: For APP CON, DEP CON See KANSAS CITY/ MUNI in Section IV-A
Remarks: P-lines S, SW. Fence E & W.

AIRPORT/FACILITY DIRECTORY

MINNESOTA—*Continued*

ASR Rnwy 11R 29L Ceil 400 Vsby 1 mi Min Alt 1240. Rnwy 22 Ceil 600 Vsby 1 mi Min Alt 1440. Rnwy 4 Ceil 500 Vsby 1 mi Min Alt 1340
ILS 110.3 I-MSP Apch Brg 295° **LOM:** 215/MS
109.3[1] I-APL Apch Brg 039° **LOM:** 338/AP
VHF/DF available, contact Tower.
(H) BVORTAC 117.3/MSP 154° 16.5NM to fld.
RBn H-SAB 266●/MSP 287° 2.4NM to fld.
Remarks: CAUTION—on apch to rnwy 11R do not descend below 1400' until radar controller has advised passing twr 2.5 from apch end rnwy 11R. [1]Unusable MM to touchdown rnwy 4. 8C unusable beyond 16 nmi. **VOT:** 111.0.

NODINE (H) BVORTAC 117.9/ODI **FSS:** LaCROSSE, WIS.

PARK RAPIDS (T) BVOR 110.6/PKD **FSS:** GRAND FORKS

REDWOOD FALLS (L) BVOR 113.3/RWF **FSS:** REDWOOD FALLS

ROCHESTER MUNI *IFR* 7S **FSS:** ROCHESTER on Fld
1310 H64/13-31(2) (Max 60) BL4,6,8A,9 S5 F4, JP4 U2 **RVV:** Rnwy 31
Tower 118.3 122.5R 121.9 278Tx **Gnd Con** 121.9
VFR ADV Ctc App Con on 119.8
App Con 119.8 122.5R 112.0T 109.9T
ILS 109.9[1] I-RST Apch Brg 307° **LOM:** 254/RS
(L) BVORTAC 112.0/RST 025X 8.3NM to fld.
Remarks: [1]Lclzr front crs unusable beyond 20 nmi.

ST. CLOUD (T) BVOR 111.6/STC **FSS:** MINNEAPOLIS

ST PAUL
ST PAUL-DOWNTOWN *IFR* 1S **FSS:** MINNEAPOLIS (DL)
703 H55/12-30(3) (Max 45) BL2,5,11 S5 F5,JP5 U2
REIL: Rnwy 30
Remarks: 4562' avbl lndg rnwy 12. NE-SW rnwy used as txwy.
St Paul Tower [1]119.1 122.5R **St Paul Gnd Con** 121.7
Radar Services:
Minneapolis App Con 120.0 121.2 126.5 122.7R 117.3T 111.8T 110.3T 109.3T 266T
Minneapolis Dep Con 119.3
Tfc Info Ctc Minneapolis App Con on 126.5.
St Paul (T)VOR 108.6/STP 289° 4.6NM to fld.
Remarks: [1]Oper 1200-0400Z.

THIEF RIVER FALLS (L) BVOR 108.4/TVF **FSS:** GRAND FORKS

TWIN CITIES RBn MHW 282/NJU

WILLMAR (T) VOR 108.4/ILL **FSS:** REDWOOD FALLS

WINONA (T) BVOR 111.4/ONA **FSS:** LA CROSSE

WORTHINGTON (L) BVOR 110.6/OTG **FSS:** REDWOOD FALLS

MISSISSIPPI

CALEDONIA (L) VORW 114.9/CBM

COLUMBUS (L) BVORTAC 116.2/UBS **FSS:** TUSCALOOSA

GREEN COUNTY (L) BVOR 110.4/GCV **FSS:** MOBILE

GREENVILLE (T) BVOR 110.2/GLH **FSS:** GREENWOOD

GREENWOOD (H) BVORTAC 114.7/GRW **FSS:** GREENWOOD

MISSISSIPPI—*Continued*

JACKSON
HAWKINS FIELD *IFR* 2NW **FSS:** JACKSON (LC 939-5212)
343 H54/16-34(2) (Max 47)[1] BL4,6 S5 F4 JP1 U2
Remarks: [1] 1529' (1949) twr 10 NM SW 1615' (1949') twr 10 NM WSW. SW 1615' (1949') twr 10 NM WSW.
Tower[2] 118.7 126.2 122.5R 278T
Radar Services:
Jackson App Con 123.9[1] 125.2[2]
Jackson Dep Con 123.9 125.2
Jackson RBn H-SAB 260●/JAN 183° 2.3NM to fld.
Remarks: [1]333°-152°. [2]153°-332°. [3]1200-0400Z.

THOMPSON FIELD *IFR* 5E **FSS:** JACKSON on Fld
345 H85/15L-33R(2) (S-120, T-150, TT-265) BL6,8 S5 F5, JP1 U2 **RVV:** Rnwy 15L.
Jackson Tower 120.9 126.2 122.7R 348T
Jackson Gnd Con 121.7
Radar Services: (BCN)
Jackson App Con 125.2[1] 123.9[2]
Jackson Dep Con 125.2[1] 123.9[2]
ASR Rnwys 15L, 33R Ceil 400 Vsby 1 mi Min Alt 745
Tfc Info: Ctc App Con
ILS[3] 110.5 I-JAN Apch Brg 153° **LOM:** 365/JA
Jackson (H) BVORTAC 112.6/JAN 152° 11.7NM to rnwy 15L.
Remarks: [1]153°-332°. [2]333°-152°. [3]Glide slope unusable below 485'.

HATTIESBURG (L) BVOR 110.6/HBG **FSS:** McCOMB

HOLLY SPRINGS (L) BVOR 112.4/HLI **FSS:** MEMPHIS

KEESLER RBn HW 391/BIX **FSS:** MOBILE

KEWANEE (L) BVOR 113.8/EWA **FSS:** MERIDIAN

LAUREL (L) BVOR 108.6/LUL **FSS:** MERIDIAN

McCOMB (H) BVORTAC 116.7/MCB **FSS:** McCOMB

MERIDIAN
KEY FIELD *IFR* 3SW **FSS:** MERIDIAN on Fld
297 H80/1-19(2) (S-45, T-120), TT-220) BL6 S3 F4, JP3 **RVV:** Rnwy 01
Remarks: Transmissometer rnwy 1. Rnwy lgts on request after midngt. Jet barrier rnwy 1-19.
Tower[1] 118.2 126.2 122.5R **Gnd Con** 121.9
Radar Services: (BCN)
Meridian App Con 120.5
Meridian Dep Con 124.8
ILS 110.1 I-MEI Apch Brg 004° BC unusable **LOM:** 356/ME
Meridian (L) BVORTAC 117.0/MEI 129° 3.5NM to fld.
Meridian RBn MHW 344/NMM 188° 4.6NM to fld.
Remarks: [1]Twr opers 1300-0500Z. Glide slope unusable below 384' MSL. LOM is HW.

NATCHEZ (L) BVOR 110.0/HEZ **FSS:** McCOMB

PICAYUNE (L) BVOR 112.2/PCU **FSS:** NEW ORLEANS

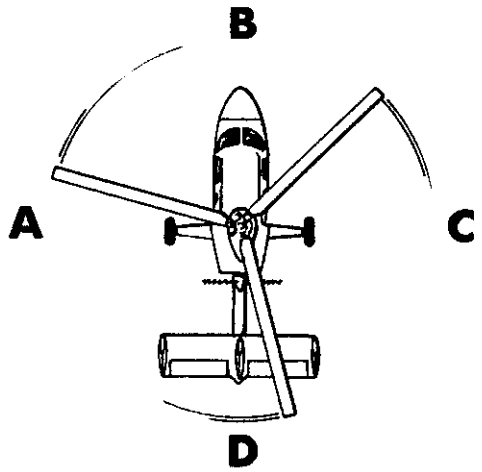
TUPELO (L) BVOR 109.8/TUP **FSS:** MUSCLE SHOALS

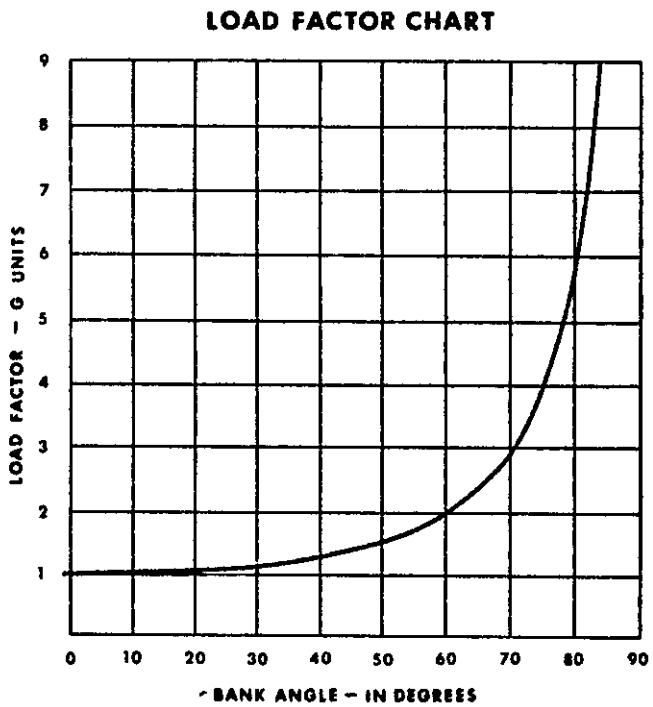
MISSOURI

BLACKWATER (L) BVOR 110.6/BWR **FSS:** COLUMBIA

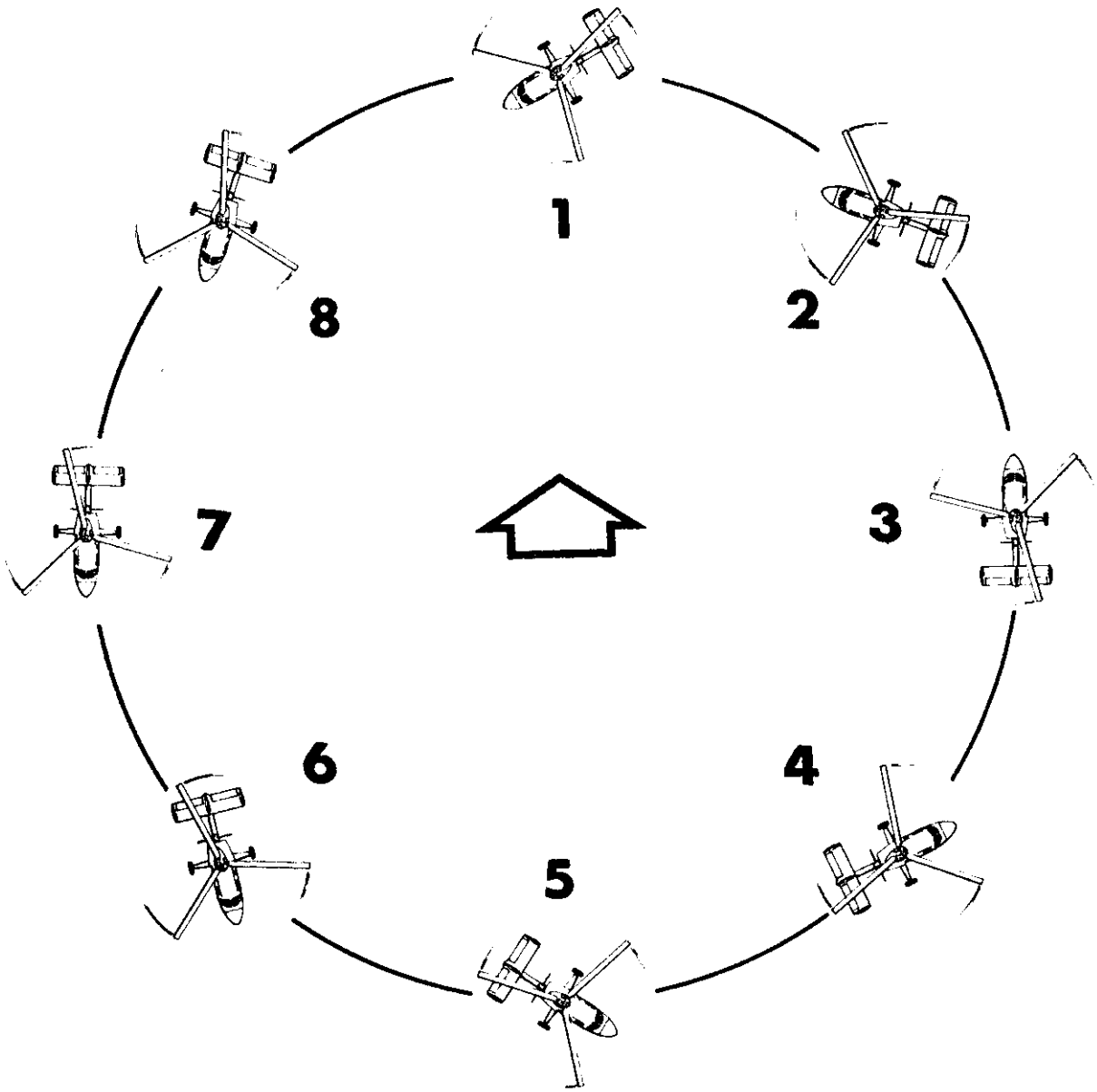
BLUE SPRINGS (L) BVOR 113.6/BSP **FSS:** KANSAS CITY

SECTION 5. MISCELLANEOUS ILLUSTRATIONS





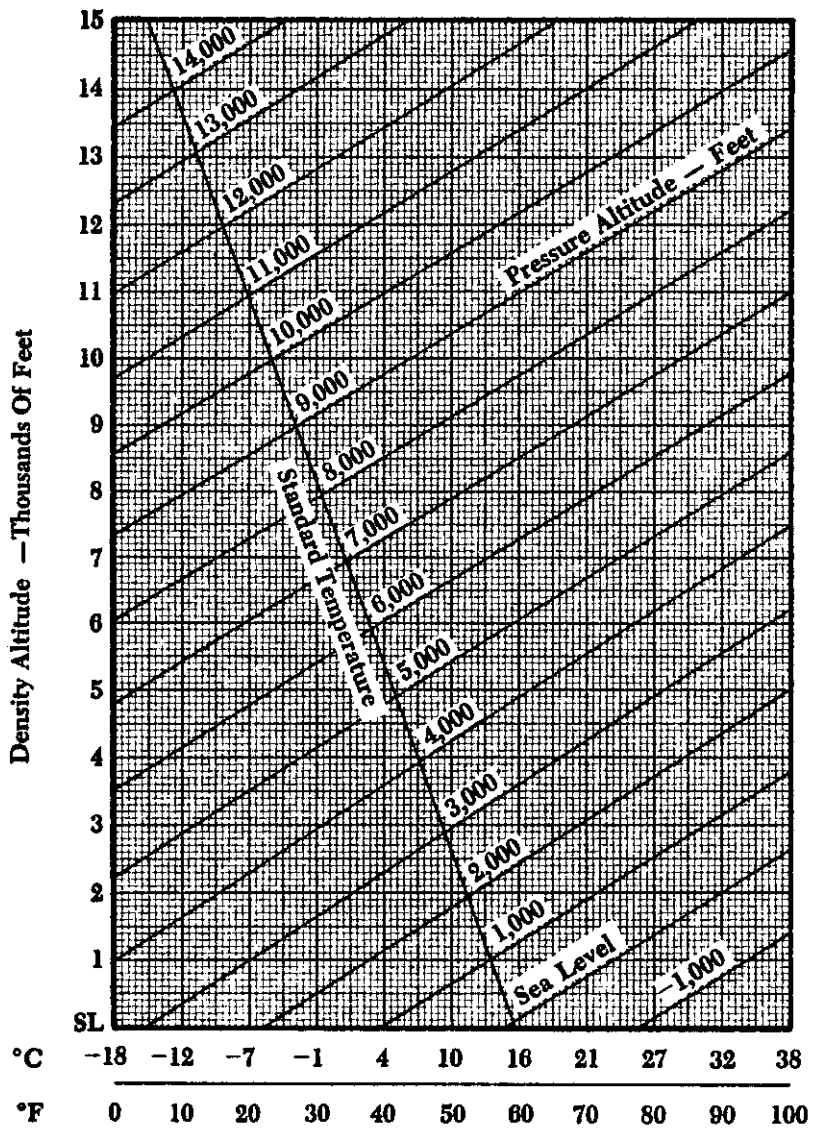
Load factors produced at varying degrees of bank at constant altitude and speed.



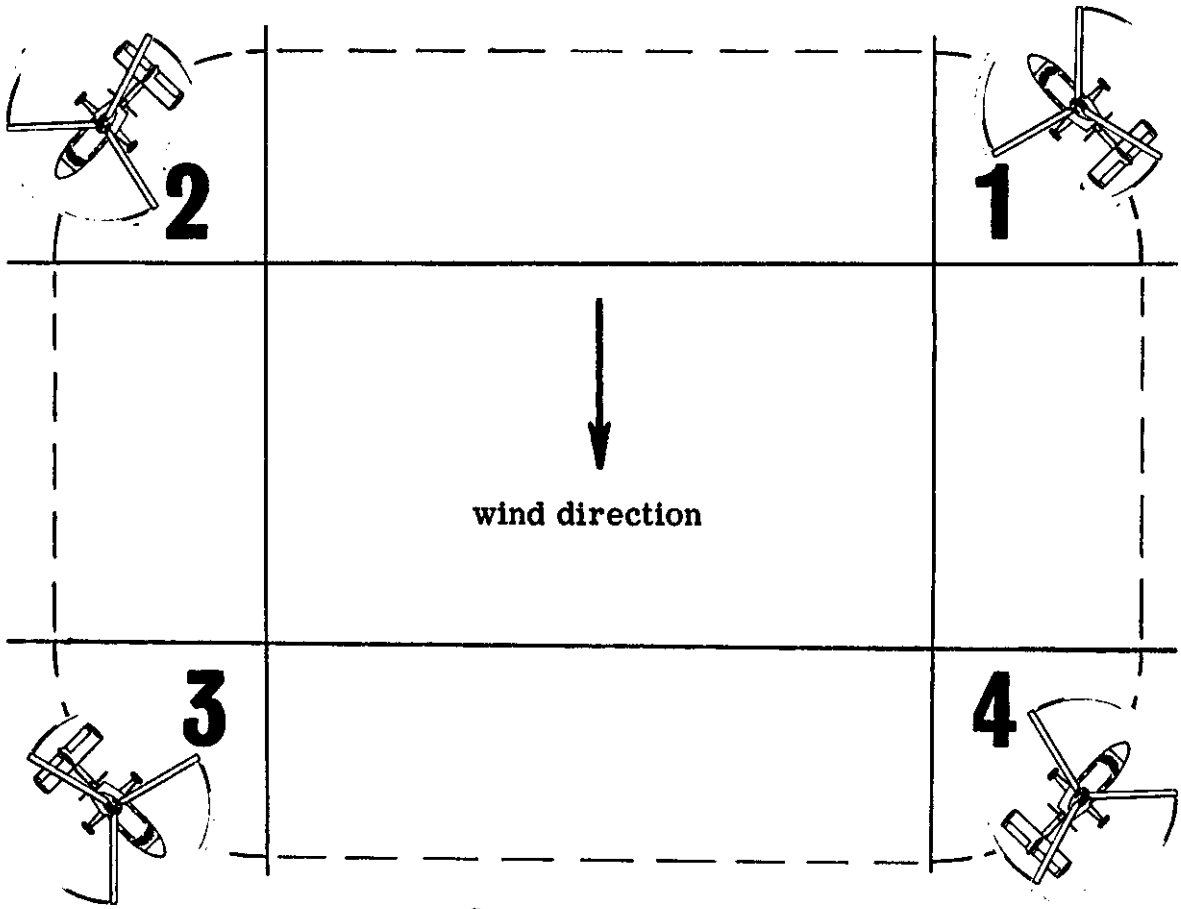
The above illustration represents a turn about a point in which a constant radius of turn is maintained. Assume that the airspeed is constant and the wind is blowing toward the direction in which the arrow points.

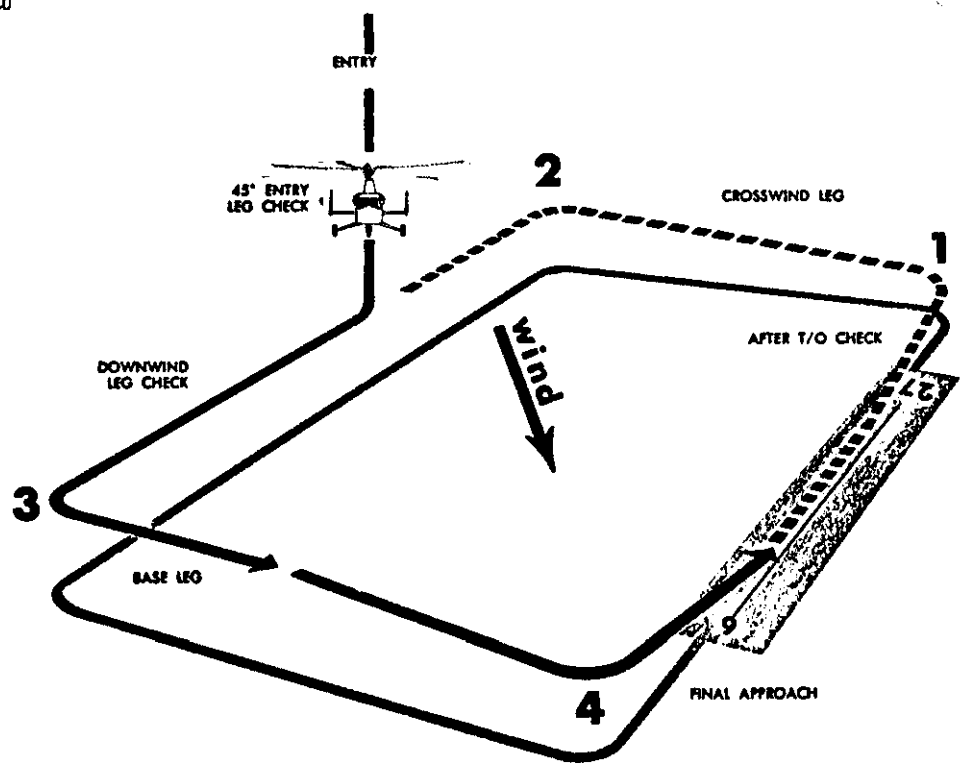
PRESSURE ALTITUDE AND DENSITY CHART

Set Altimeter to 29.92 In. Hg.
When Reading Pressure Altitude



Altitude Setting in Hg.	Altitude Addition For Obtaining Pressure Altitude
28.0	1,825
28.1	1,725
28.2	1,630
28.3	1,535
28.4	1,435
28.5	1,340
28.5	1,340
28.6	1,245
28.7	1,150
28.8	1,050
28.9	955
29.0	865
28.1	770
29.2	675
29.3	580
29.4	485
29.5	390
29.6	300
29.7	205
29.8	110
29.9	20
29.92	0
30.0	−75
30.1	−165
30.2	−225
30.3	−350
30.4	−440
30.5	−530
30.6	−620
30.7	−710
30.8	−805
30.9	−895
31.0	−965


2
1
wind direction
3
4


ENTRY
45° ENTRY LEG CHECK
2
CROSSWIND LEG
1
AFTER T/O CHECK
wind
DOWNWIND LEG CHECK
3
BASE LEG
4
FINAL APPROACH