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Ranger

OPERATORS MANUAL

MODEL
M20C

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Foreword . . . . . .

This manual is issued as your operating guide for the Mooney RANGER. It is important that you--regardless of your previous experience--carefully read the handbook from cover to cover and review it frequently.

> IMPORTANT: THIS MANUAL CONTAINS Federal Aviation Administration APPROVED LIMITATIONS AND MUST BE CARRIED IN THE AIRCRAFT AT ALL TIMES.

All information and illustrations in this manual are based on the latest product information available at the time of publication approval. The right is reserved to make changes at any time without notice. Every effort has been made to present the material in a clear and convenient manner to enable you to use the manual as a ready presentation and content recommendations is solicited.

Warranty . . . . . .

Mooney warrants each Aircraft (which includes its accessories and equipment) sold hereunder, to be free from defects in material and workmanship under normal use and service when operated in accordance with Mooney's operating instructions during the period of six (6) months following delivery of the Aircraft to the original retail purchaser or the first user or during the period of one (1) year following the date of issue of the original airworthiness certificate for the Aircraft, whichever period first terminates. Mooney does not make any warranties with respect to equipment and accessories not manufactured by Mooney but Mooney assigns to any owner of such Aircraft (to the extent same may be assignable) any warranties Mooney has received from the manufacturers of such equipment and accessories and will, on request, provide and execute such instruments as may be reasonably required to evidence such assignment. Mooney's obligation under this warranty is limited to repairing or replacing, at Mooney's option, any part or parts which within the applicable warranty period set forth above, shall be returned, transportation charges prepaid, to Mooney's plant in Kerrville, Texas or to such other location designated by Mooney, and which upon examination, shall disclose to Mooney's satisfaction that such part is defective. A new warranty period is not established for parts replaced hereunder. Parts replaced hereunder are warranted for the remainder of the original warranty period applicable to Aircraft sold hereunder. The repair or replacement of defective parts under this warranty shall be made by Mooney without charge for the parts, or labor for removal, installation and/or actual repair of defective parts.

This warranty does not apply to Aircraft, equipment, accessories, or other parts manufactured or sold by

Mooney which have been subject to misuse, negligence, accident or improper installation, or which have been repaired or altered outside of Mooney's plant in a way which, in the opinion of Mooney, adversely affects its performance or reliability. Further, this warranty does not include normal maintenance services (such as engine tune-up, cleaning, control rigging, brake and other mechanical adjustments, maintenance inspections, etc.) and the replacement of service items (such as spark plugs, brake linings, filters, hoses, belts, tires, etc.) made in connection with such services or required as maintenance, nor to normal deterioration of soft trim and appearance items (such as, paint, upholstery, rubber-like items, etc.) due to wear and exposure.

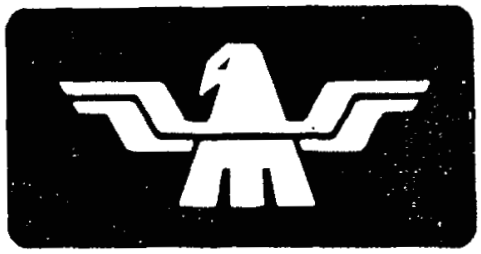
This warranty shall extend to any owner (hereafter "Owner") of the Aircraft making claim within the specified warranty period.

THIS WARRANTY BY MOONEY IS MADE EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES EXPRESSED OR IMPLIED IN FACT OR BY LAW, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND IS IN LIEU OF ANY OTHER OBLIGATION OR LIABILITY ON THE PART OF MOONEY TO ANYONE OF ANY NATURE WHATSOEVER BY REASON OF THE MANUFACTURE AND/OR THE SALE AND/OR THE USE OF SUCH AIRCRAFT. MOONEY SHALL IN NO EVENT BE LIABLE TO ANY OWNER OR TO ANY OTHER PARTY OR PARTIES FOR SPECIAL, INCIDENTAL OR CONSEQUENTIAL LOSS OR DAMAGES OR FOR ANY OTHER LOSS OR DAMAGE TO PROPERTY AND/OR INJURY OR DEATH TO PERSONS OTHER THAN FOR THE PROPERTY DAMAGE TO SUBJECT AIRCRAFT PROXIMATELY RESULTING FROM ANY BREACH BY MOONEY OF THE AFORESTATED WARRANTY, MOONEY NEITHER ASSUMES NOR AUTHORIZES BUYER OF ANYONE ELSE TO ASSUME FOR IT ANY OBLIGATION OR LIABILITY IN CONNECTION WITH THE AIRCRAFT SUBJECT HEREOF, OTHER THAN THOSE EXPRESSLY SET OUT HEREIN. NO BILL OF SALE OR TRANSFER OF TITLE TO THIS AIRCRAFT SHALL NULLIFY THE PROVISIONS HEREOF.

SECTION I. GENERAL DESCRIPTION

DESIGN FEATURES

SPECIFICATIONS OUTLINE



DESIGN FEATURES

The MOONEY RANGER (M20C) is a low-wing four-place aircraft with a retractable gear. A four-cylinder engine powers the aircraft for economical, high-performance flight. Licensing under Federal Aviation Administration regulations assures that your Mooney meets the requirements of Normal Category aircraft.

AIRFRAME

The airframe has a welded, tubular-steel cabin structure enclosed in sheet-aluminum skins. Stressed skins rivet to main and auxiliary spars in the wing, stabilizer, and vertical fin. The laminar-flow wing has full wrap-around skins with flush riveting over the forward top two thirds of the wing area.

For pitch trim control, the empennage pivots on the aft fuselage. A torque-tube-driven jack screw, bolted to the rear tailcone bulkhead, sets the stabilizer angle.

The forward-opening cabin door provides access to both front and rear seats. The baggage compartment door is above the wing trailing edge to enable baggage loading from the ground.

POWER PLANT

The powerplant is a four-cylinder air cooled engine that develops 180 horsepower. A 60-ampere 12-volt alternator supplies ample electrical power for all standard and optional equipment at all engine speeds from warmup to flight power settings.

The hydraulic propeller governor, using oil pressure for increasing blade pitch to control engine speed, regulates the controllable-pitch constant-speed propeller. Spring and blade aerodynamic forces decrease blade pitch.

FLIGHT CONTROLS

Conventional dual controls link to the control surfaces through push-pull tubes. The co-pilot's rudder pedals are removable.

The Mooney Positive Control (P.C.) system is standard equipment. P.C. is a lateral stability augmentation system that provides a high degree of roll and yaw stability, thereby enhancing the inherent wings-level flight characteristics of the aircraft. The system works full time from takeoff through landing but can be easily deactivated or overpowered for flight maneuvers. P.C. allows you, the pilot, to devote more time to navigation, traffic surveillance, and communications.

LANDING GEAR

The tricycle landing gear allows maximum taxi vision and ground maneuvering. Hydraulic disc brakes and a steerable nose wheel aid in positive directional control during taxiing and crosswind landings.

The landing gear is electrically actuated. A gear warning horn along with red and green position lights help prevent inadvertent gear-up landings. The retraction system incorporates a squat switch that prevents gear retraction until a safe airspeed is attained. An emergency gear extension system is provided.

SPECIFICATIONS OUTLINE

POWER PLANT

TYPE: Four-cylinder, air cooled, horizontally opposed,

and carbureted engine with a wet-sump lubricating system.

Model (Lycoming)	O-360-A1D
Rated Horsepower @ 2700 RPM	180 BHP
Bore	5.125 IN.
Stroke	4.375 IN.
Displacement	361.0 CU. IN.
Compression Ratio	8.7:1
Carburetor, Marvel-Schebler	MA-4-5
Magnetos, Scintilla	S4LN-200 Series

PROPELLER

TYPE: Constant-speed, hydraulically controlled propeller with a single-acting governor.

Model (Hartzell)	HC-C2YK-1B/7666 A-2
Diameter	74 IN.
Blade Angle (@ 30 IN. STA):	
Low	$13^{o} \pm 0^{o}$
High	$29^{o} \pm 2^{o}$

LANDING GEAR

TYPE: Electrically retracted tricycle gear with rubber shock discs, steerable nose wheel, and hydraulic disc brakes.

Wheel Base	5 FT 6-9/16 IN.
Wheel Tread	9 FT 3/4 IN.
Tire Size:	
Nose	5.00 x 5
Main	6.00 x 6
Tire Pressure:	
Nose	30 PSI
Main	30 PSI

FUEL & OIL

Usable Fuel Capacity	52 GAL
Minimum Fuel Octane Rating (aviation grade)	91/96
Oil Capacity (6 QTS MIN for flight)	8 QTS

WEIGHT & LOADING

Gross Weight	2575 LBS
Approximate Empty Weight (with standard equipment)	1525 LBS
Useful Load	1050 LBS
Wing Loading @ Gross Weight	15.1 PSF
Power Loading @ Gross Weight	14.3 PHP

BAGGAGE COMPARTMENT

Maximum Baggage Loading (unless limited by weight envelope)	120 LBS

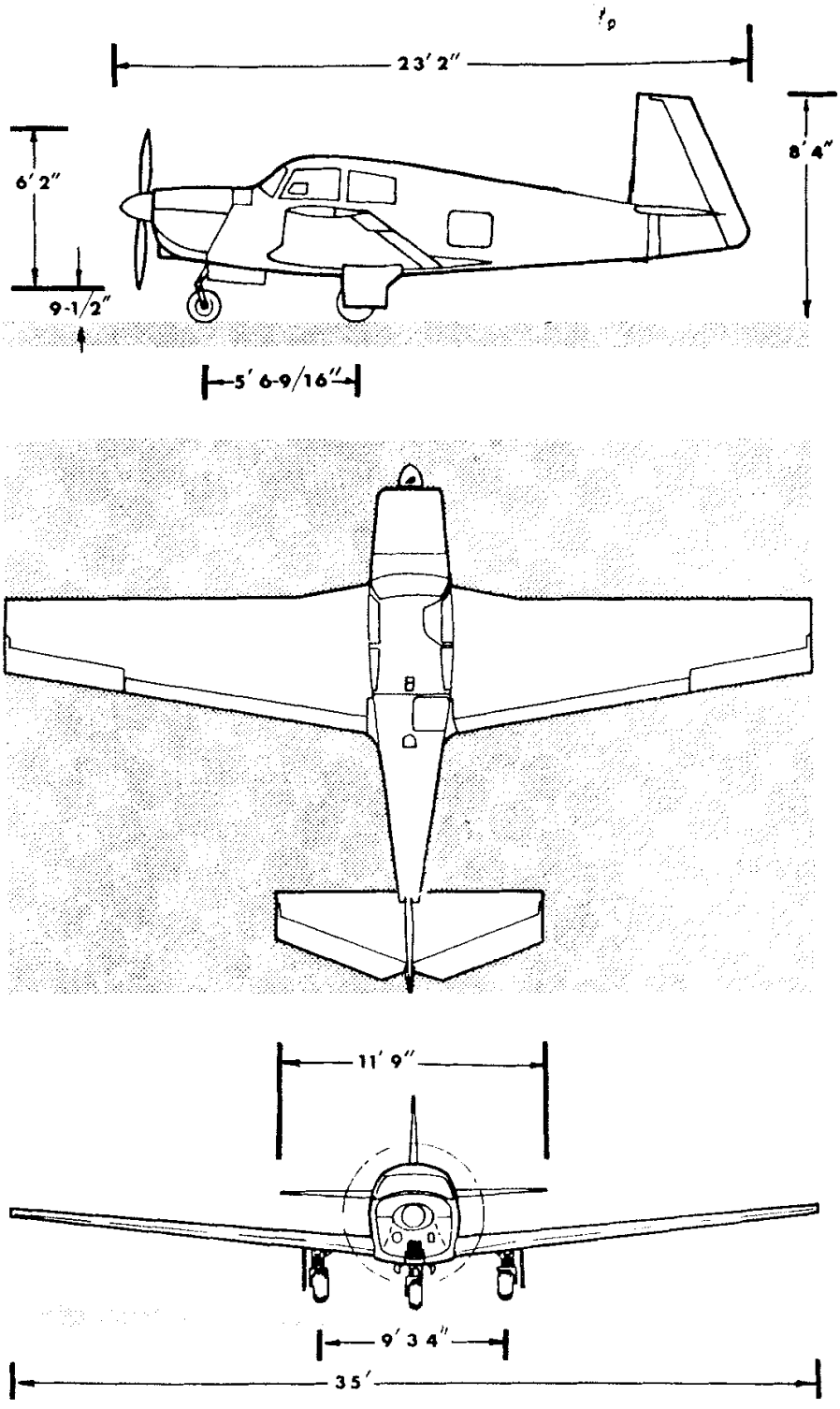


FIGURE 1-1 DIMENSIONED THREE VIEW

SECTION II. SYSTEMS OPERATIONS

POWER PLANT

INSTRUMENTS

FLIGHT CONTROLS

LANDING GEAR

ELECTRICAL POWER

CABIN ENVIRONMENT

CABIN

Acquiring a working knowledge of the aircraft's controls and equipment is one of your important first steps in developing a fully efficient operating technique. This Systems Operations section describes location, function and operation of systems' controls and equipment. It is advisable for you, the pilot, to familiarize yourself with all controls and systems while sitting in the pilot's seat and rehearsing the systems operations and flight procedures portions of this manual.

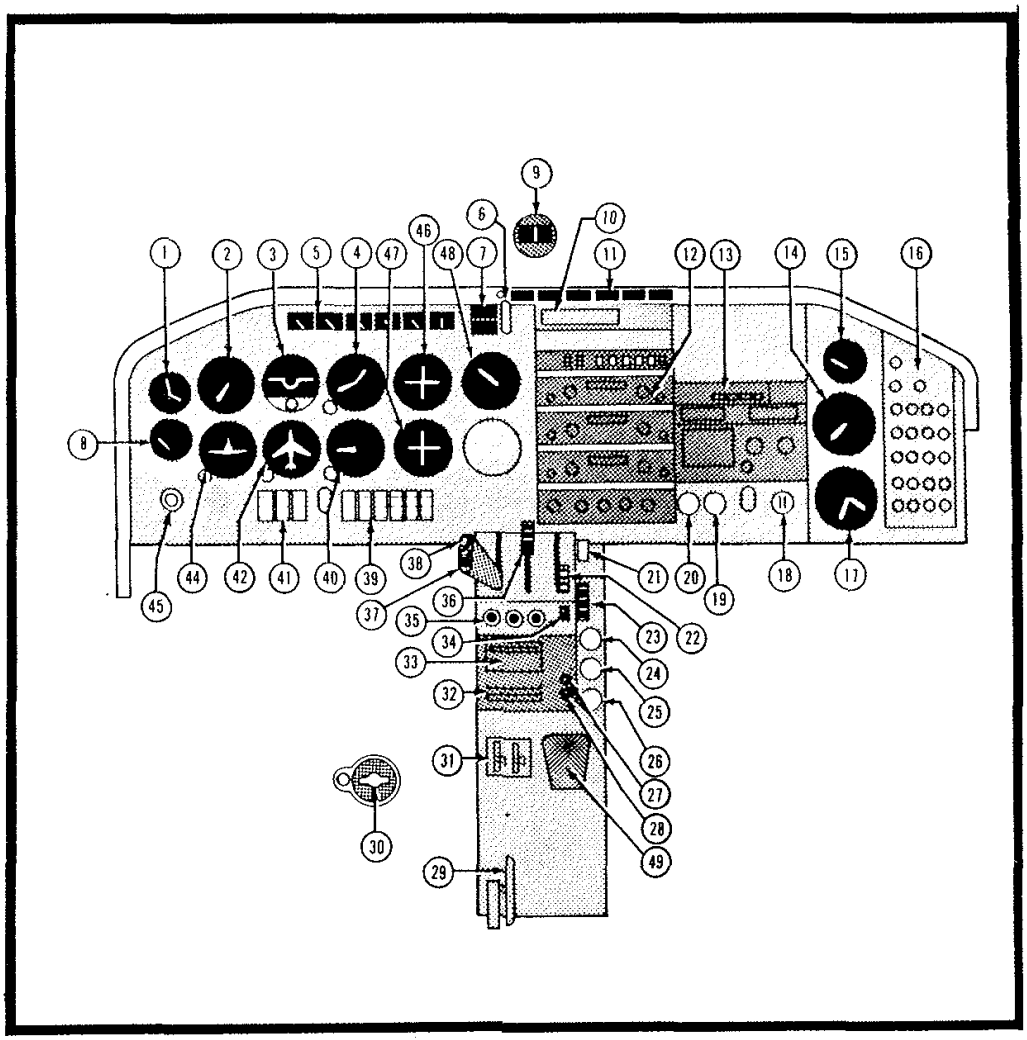


FIGURE 2-1. INSTRUMENT PANEL

POWER PLANT

ENGINE CONTROLS

The engine control levers are centrally located, between the pilot and co-pilot, on the engine control pedestal. The throttle lever regulates manifold pressure. Pushing the lever forward increases the setting; pulling the lever aft decreases the setting.

The propeller control lever, with its crowned knob, controls engine RPM through the propeller governor. Pushing the lever forward increases engine RPM; pulling the lever aft decreases RPM.

The mixture control lever, with its red hexagon knob, establishes the fuel-air ratio (mixture). Pushing the lever full forward sets the mixture to full-rich, pulling the lever aft leans the mixture, and pulling the lever to its maximum aft travel position closes the idle cutoff valve, shutting down the engine. Precise mixture settings may be established by observing the optional EGT gage while adjusting the mixture control lever.

A large friction lock on the right side of the engine control pedestal locks the controls in the desired setting and prevents creeping during flight.

The carburetor heat control knob, mounted in the subpedestal to the right of the engine control pedestal, allows the selection of heated induction air to prevent carburetor icing or to melt accumulated ice in the carburetor venturi. The engine will operate on unfiltered air when the carburetor heat control knob is pulled out, and dirt and foreign substances can be taken into the engine causing rapid cylinder and piston wear. Therefore, the use of carburetor heat on the ground, except for testing system operation, is not recommended.

1. Clock
2. Airspeed Indicator
3. Artificial Horizon
4. Altimeter
5. Engine Cluster Gage- Fuel Quantity, Oil Temp, Oil Pressure, Cylinder Head Temperature, Ammeter
6. Landing Gear Switch
7. Landing Gear Position Lights
8. Outside Air Temperature Gage
9. Magnetic Compass
10. Pilots Check List
11. Annunciator Lights - Aircraft Registration, Landing Lights, Fuel Pressure, High & Low Vacuum, High and Low Voltage
12. Radio Panel
13. Radio Panel
14. Manifold Pressure and Fuel Pressure Gage
15. Carburetor Air Temp Gage or Exhaust Gas Temperature Gage
16. Circuit Breaker Panel
17. Tachometer
18. Cigar Lighter
19. Not Used.
20. Carburetor Heat Control
21. Flap Control Switch
22. Mixture Control
23. Quadrant Friction Control
24. Parking Brake Control
25. Cabin Vent Control
26. Cabin Heat Control
27. Microphone Jack
28. Headset Jack
29. Trim Control Wheel
30. Fuel Tank Selector Valve
31. Trim and Flap Position Indicator
32. Heater and Vent Louvers
33. Ash Tray
34. Instrument Light Color Selector - Red & White
35. Instrument Panel Light Controls
36. Propeller Governor Control
37. Throttle
38. Landing Light Switch
39. Electrical Circuit Breaker/Switch
40. Rate of Climb Indicator
41. Electrical Circuit Breaker/Switches
42. Directional Gyro
43. Not Used
44. Turn Coordinator
45. Magneto/Starter Switch
46. Omni Indicator
47. Omni Indicator
48. ADF Indicator
49. Radio Microphone

All engine instruments except the EGT gage, tachometer and fuel and manifold pressure gages are grouped in the left instrument panel. Color arcs on instrument faces mark operating ranges. Proper interpretation of engine instrument readings is essential for selecting optimum control settings and for maintaining maximum cruise fuel economy. Engine limitations are given in Section IV.

IGNITION SYSTEM

The left magneto has a set of fixed retard breaker points that aid in smoother, easier starting. A battery-powered starting vibrator supplies a long-duration, boosted spark.

The starter-ignition switch, mounted on the left of the instrument panel, combines both ignition and starting functions. Turning the ignition key clockwise through R, L, and BOTH to the START MAG position and then pushing forward on the key and receptacle engages the starter. Releasing the key when the engine starts allows the switch to return by spring action to the BOTH position. For safety, the starter-ignition switch must be left at OFF when the engine is not running.

FUEL SYSTEM

Two integral sealed sections carry the fuel in the forward inboard area of the wings. Full fuel capacity is 52 gallons. There are sump drains at the lowest point in each tank for taking fuel samples to check for sediment contamination and condensed water accumulation. Section VII discusses the fuel sampling procedure.

The recessed three-position fuel selector handle on the cabin floor sets the selector valve below the floorboard for LEFT tank, RIGHT tank, or the OFF position. The fuel selector valve assembly contains a valve for draining condensed water and sediment from the lowest point in the

fuel lines before the first flight of the day and after each refueling. Section VII discusses the selector valve flushing procedure.

Fuel feeds from one tank at a time to the selector valve and through the electric fuel pump enroute to the engine-driven pump and the carburetor unit. Electric fuel-level transmitters in the tanks operate fuel gages in the engine cluster. The master switch actuates the fuel quantity indicator system to maintain an indication of fuel remaining in each tank. The fuel pressure gage registers fuel pressure in the line to the carburetor. Vents in each fuel tank allow for overflow ventilation.

OIL SYSTEM

The engine has a full-pressure wet-sump oil system with an 8 quart capacity. The automatic bypass control valve routes oil flow around the oil cooler when operating temperatures are below normal or when the cooling radiator is blocked.

The engine oil should be kept at 6 to 8 quarts. Lycoming Service Instruction 1014 (latest revision) gives recommended oil specifications and oil change intervals.

ENGINE COOLING

The down-draft engine cooling system provides ground and inflight power plant cooling. Engine baffling directs air over and around the cylinders and out the cowl flap openings. Cowl flap doors are fixed in a position that allows proper air flow on the ground and in flight.

VACUUM SYSTEM

An engine-driven vacuum pump supplies suction for the vacuum-operated gyroscopic flight instruments and the

Mooney Positive Control system. Air entering the vacuum-powered instruments is filtered; hence, sluggish or erratic operation of vacuum-driven instruments may indicate that a clogged vacuum filter element is preventing adequate air intake. The vacuum annunciator light will illuminate steadily for Hi Vac and flashes for Low Vac indication.

INSTRUMENTS

FLIGHT INSTRUMENTS

All primary flight instruments are grouped on the shock-mounted flight panel directly in front of the pilot's seat. Optional gyro instruments may be installed in the standard T-grouping with the attitude gyro at top center and the directional gyro immediately below. The standard airspeed indicator and sensitive altimeter cross the "T". The standard turn coordinator and optional vertical speed indicator at left of center complete the flight instrumentation.

The magnetic compass is mounted on the windshield post above the instrument panel. A remote indicating gage is installed in the left of the flight panel. There is space and lighting for four optional radio indicators on the right side of the flight panel.

A pitot tube, mounted on the lower surface of the left wing, picks up airspeed indicator ram air. A heated pitot prevents pitot tube icing when flying in moisture-laden air. A drain valve is located on the forward bottom skin of the left wing just outboard of the wing fillet. Static ports on each side of the tail cone supply static air pressure for the altimeter, the airspeed indicator, and the vertical speed indicator. A drain valve is located on the fuselage bottom skin below the tail cone access door. An alternate static pressure source valve will be found under the left side of the flight panel.

A stall warning horn, mounted in the cabin head liner and triggered by a sensing vane on the left wing leading edge, will sound when airspeed drops to near stall speed. The sound becomes steady as the aircraft approaches a complete stall.

There are two landing gear position lights; one is a green GEAR DOWN light and the other is a red IN-TRANSIT light. No light shows when the gear is full up. Inadvertent positioning of the gear switch to the up position while the aircraft is on the ground will cause both the red and green to be illuminated and the warning horn to sound if the throttle is closed.

FLIGHT CONTROLS

PRIMARY FLIGHT CONTROLS

Push-pull tubes with self-aligning rod end bearings actuate the primary flight control surfaces. Beveled aileron trailing edges help reduce pilot control forces required for flight

maneuvering. A spring-loaded interconnect device indirectly joins the aileron and rudder control systems to assist in lateral stability during flight maneuvers. Control surface gap seals minimize airflow through the hinge slots and reduce drag.

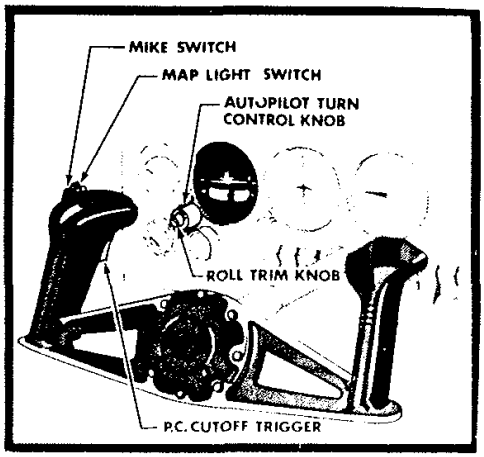


FIGURE 2-2. P.C. SYSTEM CONTROLS

POSITIVE CONTROL

The Mooney Positive Control (P.C.) system provides a high degree of roll and yaw stability, thereby enhancing the inherent wings-level flight characteristics of the aircraft. Positive Control will hold a reasonable heading over a long period of time when the aircraft is trimmed properly. However, without the installation of a magnetic heading lock, P.C. will not maintain an absolute preselected heading.

The system is a pneumatically operated, two-axis automatic control superimposed on the primary flight control systems. An electro-vacuum powered turn coordinator supplies pneumatic inputs to servo units that link to the aileron and rudder control systems. Since the engine-driven vacuum pump is the power source, P.C. is operative whenever the propeller is windmilling at more than 1000 RPM.

The trigger switch on the left hand grip of the pilot's control wheel is shown in Figure 2-2. Depressing this switch any time during flight will render the Positive Control system completely inoperative for flight maneu-

vers or manual flying. When the cutoff switch is released, the aircraft will return unassisted to wings-level flight. P.C. can be manually overridden with little effort if the system should malfunction. Manually over-powering the system will not damage the aircraft or the P.C. components.

The roll-trim knob on the turn coordinator, as shown in Figure 2-2, provides an aileron trim function through the P.C. system. Rotating the knob trims the aircraft about its roll axis to compensate for asymmetrical fuel and passenger loadings.

The P.C. system is installed to help alleviate pilot fatigue. But like any other system in the aircraft, P.C. must be monitored for proper functioning.

TRIM CONTROLS

For pitch trim control, the entire empennage pivots on the tail cone attachment points to increase or decrease the horizontal stabilizer angle. This design allows flight trim establishment with minimum control surface deflection. A trim indicator located on the console indicates stabilizer trim position. Forward rotation of the trim wheel lowers the nose; rearward rotation raises the nose in flight.

WING FLAP CONTROLS

The flap control on the right of the engine control pedestal operates the electrically-actuated wide-span wing flaps. Moving the control to the UP position, retracts the flaps. The position of the flaps can be noted from the flap position indicator. The control has a detent to assist the pilot in detecting the takeoff flap setting.

LANDING GEAR

ELECTRIC GEAR RETRACTION SYSTEM

The two-position electric gear control switch, identified by its wheel-shaped knob, is located at the top of the instrument panel above the throttle.

There are three ways to see that the electrically-actuated gear is down-and-locked:

(1) The green gear-down annunciator light illuminates.
(2) The indicator marks align as seen on the floorboard visual gear-position indicator.
(3) The gear warning horn does not sound at approach power setting of below 12 inches manifold pressure.

A green GEAR DN light, a red IN TRANSIT light, and a warning horn provide visual and audible gear position signals. The green light (GEAR DN) shows continuously when the gear is fully extended. Both lights are out when the gear is fully retracted.

The illuminated gear-down position indicator in the floorboard aft of the center console has two marks that align when the gear is down.

Retarding the throttle below 12 inches manifold pressure causes the gear warning horn to emit a regular, intermittent tone unless the gear is down-and-locked.

A mechanically actuated "Squat-Switch" in the retraction system prevents inadvertent landing gear retraction. The safety switch is not intended to substitute for the gear switch in keeping the gear extended while taxiing, taking off, or landing.

EMERGENCY GEAR-EXTENSION SYSTEM

The emergency gear extension handcrank on the left upholstery panel near the pilot's knee is for manually driving the electric gear actuating motor to extend the gear if the electrical system should malfunction. Section IV discusses the emergency gear extension procedure.

BRAKE & STEERING SYSTEMS

The main gear wheels incorporate self-adjusting disc-type hydraulic brakes. The pilot's rudder pedals have individual toe-actuated brake cylinders linked to the rudder pedals. Depressing the toe pedals and pulling out the parking brake control on the console sets the brakes for parking. Pushing the parking brake control forward releases the brakes.

It is inadvisable to set the parking brake when the brakes are overheated after heavy braking or when outside temperatures are unusually high. Trapped hydraulic fluid may expand with heat to damage the system. Wheel chocks are normally used for long-term parking and mooring.

Rudder pedal action steers the nose wheel. Gear retraction relieves the rudder control system of its nose wheel steering and centers the wheel to permit retraction into the nose wheel well.

ELECTRICAL POWER

ALTERNATOR & BATTERY

A 35-ampere-hour 12 volt negative-ground storage battery under the left engine cowl and a 60-ampere alternator

supply electrical power for equipment operation. The ammeter in the engine instrument display indicates battery charging rate. A power loss in the alternator or voltage regulator will be shown as a discharge reading on the ammeter; a discharged battery will be indicated as a high-charge reading.

The voltage regulator adjusts alternator output to current load while maintaining a constant voltage level. An alternator warning light illuminates steadily when voltage regulator output exceeds voltage limits. It flashes when the voltage is low.

CIRCUIT BREAKERS

Push-to-reset, push-pull, or rocker-switch circuit breakers protect all of the electrical circuits. Circuit breakers automatically break the electrical current flow if the systems receive an overload, thus preventing damage to electrical wiring. The main circuit breaker panel is in the extreme right panel. Figure 2-3 illustrates the main circuit breaker panel with its push-pull standard equipment circuit breakers. All rocker-switch circuit breakers are at the bottom of the flight panel.

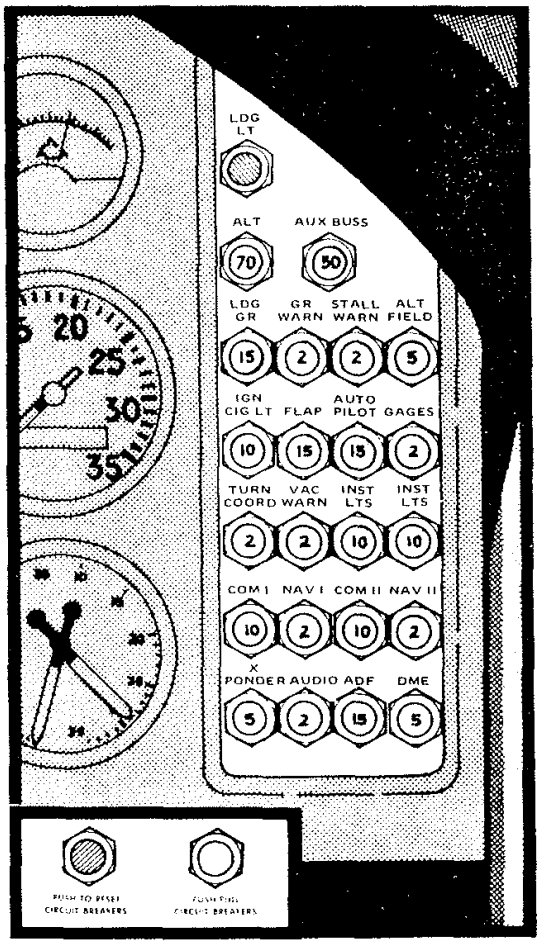


FIGURE 2-3.
MAIN CIRCUIT
BREAKER PANEL

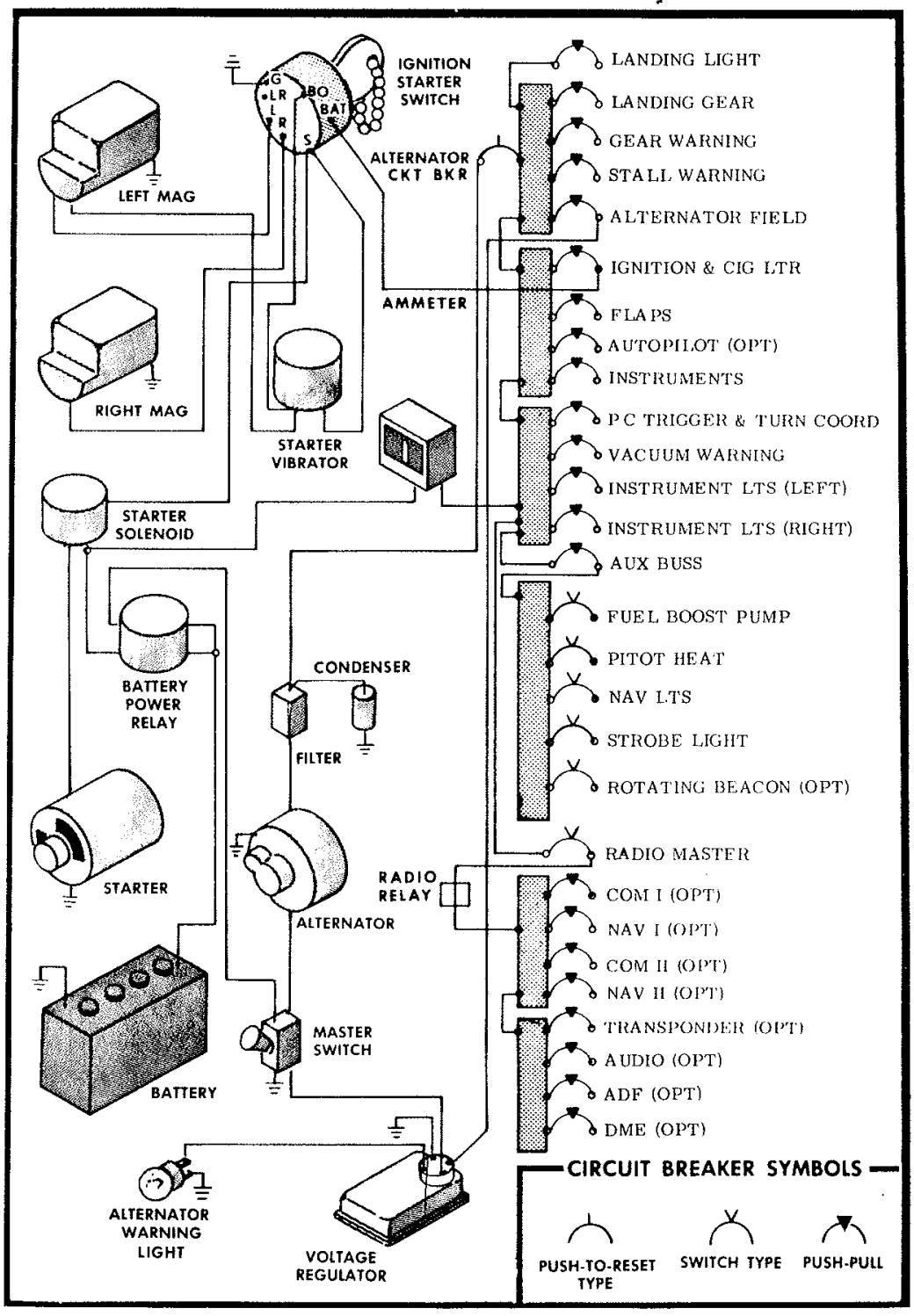


FIGURE 2-4. ELECTRICAL SYSTEM SCHEMATIC

The alternator push-pull circuit breaker on the main breaker panel furnishes an emergency overload break between the alternator and the individual push-pull circuit breakers. Resetting the alternator circuit breaker will usually restore an overloaded circuit. If pressing the button a second time does not reactivate the circuit, the alternator circuit breaker must remain open and the alternator-field circuit breaker must be pulled out to break the alternator excitation circuit. Since the alternator is then cut out of the power circuit, the storage battery supplies electrical power in steadily diminishing output with the master switch on.

The alternator-field push-pull circuit breaker furnishes an emergency break in the alternator field excitation circuit in the event of alternator or voltage regulator malfunction. If the regulator output voltage exceeds limits, the red alternator warning light illuminates steadily. Turning off all radio equipment, and then turning master switch off and on, will reset the voltage regulator. The alternator annunciator light should remain out. If the alternator light comes on again, pulling out the alternator-field circuit breaker cuts the alternator out of the power circuit. Once again the battery is the only source of electrical power; therefore, all electrical equipment not essential for flight should be turned off and the flight terminated as soon as practical to correct the malfunction.

ANNUNCIATOR LIGHTS

The landing gear lights are at the top of the instrument panel by the landing gear switch. Annunciator lights

for the registration number, landing light, alternator, vacuum, and fuel pressure are in the glare shield. The purpose and function of each of these lights is discussed elsewhere in this section.

INSTRUMENT & PLACARD LIGHTS

All instrument faces and placards are floodlighted by light bulbs in the glare shield. Rheostat knobs on the control quadrants control the intensity of instrument and placard lighting. Rotating the knobs clockwise turns on and increases light intensity.

CABIN LIGHTING

An adjustable eyeball dome light illuminates the cabin and also serves as a backup spotlight for illuminating the instrument panel; its ON-OFF-DIM switch is slightly forward and to the right of the dome light.

CABIN ENVIRONMENT

HEATING & VENTILATION SYSTEMS

Two ventilating systems provide cabin environmental control suited to individual pilot and passenger preferences. Fresh air heated by the engine exhaust muffler, and cool air from an airscoop on the co-pilot side, can be individually controlled and mixed to the desired temperature.

The left side fresh-air scoop has an adjustable eyeball inlet near the pilot's knee.

The cabin overhead ventilating system works independently of the cabin heating and ventilating system. Rotating the knob above the pilot seat extends or retracts the overhead airscoop to control air intake and to prevent air-buffeting at high cruising speeds. Small directional vent deflectors with inner knob air volumn controls, within easy reach of each occupant, distribute incoming outside air as individually desired.

The cabin heat control is marked CABIN HEAT. Opening the side airscoop control (labeled CABIN VENT) and setting the cabin heat control turns on cabin heat. To lower cabin temperature, the cabin heat control is pushed toward the OFF position. Completely closing the cabin heat control and fully opening the cabin vent control, with the overhead airscoop extended, supplies maximum fresh air circulation. In case of engine fire, the cabin heating system must be turned off.

The right side airscoop has outlets under the side panel for installation of radio or autopilot equipment cooling ducts.

WINDSHIELD DEFROSTING SYSTEM

The defrosting system takes warm air from the cabin heating system ductwork and distributes this air over the windshield interior surfaces. The system works full time without a separate control.

CABIN

SEATS & SAFETY BELTS

The front seats are individually mounted and may be adjusted fore and aft to fit individual comfort preferences. Resetting a seat back is accomplished by pulling the seat back forward, rotating the large cam selector knob at the lower back juncture, and allowing the back to return to the new position. The rear seat back can be adjusted by leaning forward in the seat, pulling the catch lever at the forward end of the side panel arm rest, and adjusting the seat back to the desired position.

Safety belts, if worn properly, keep occupants firmly in their seats in rough air and during maneuvers. These belts are mechanically simple and comfortable to wear. They are attached to the seat so the seat can be moved without readjusting the belt.

BAGGAGE & CARGO AREAS

The baggage compartment has 15 cubic feet of baggage or cargo space and two pair of floor tiedown straps. The loose equipment, consisting of tiedown eyebolts, jackpoints, tiedown rings, a fuel sampling cup, and a towbar is stowed in the baggage compartment. The rear seat backs can be removed for additional cargo space by pulling the springloaded lock pins at the seat back base and sliding the seat back rearward.

SECTION III. NORMAL PROCEDURES

GROUND OPERATIONS

FLIGHT OPERATIONS

Before flying your Mooney, it is necessary that you become thoroughly familiar with all techniques needed to operate its systems and equipment safely and efficiently.

This section of the manual provides you with a quick and easy reference to normal operating procedure recommendations. Checklist procedures are enumerated in steps that cover cockpit controls and instruments in left-to-right and top-to-bottom patterns. These procedures are intended to assist you in developing good flying techniques under average conditions. While close attention to each step is important for safe and efficient operation, sound judgment may occasionally be called for in making exceptions when circumstances require a deviation in operating procedure.

GROUND OPERATIONS

PREFLIGHT

In addition to completing the preflight check, visually inspect all of the aircraft exterior prior to each flight with particular attention to detection of loose rivets and dents. When checking under the aircraft, look for fuel and oil leaks indicated by oil runs or fuel dye stains.

> WARNING: Check the aircraft weight and balance before proceeding with the flight. Consult the Weight & Balance Record, furnished in the airplane file, for detailed data needed to calculate load distribution and limitations.

Standard atmospheric temperatures are below freezing above 8000 feet altitude, and it is possible that condensed water in the fuel lines will freeze to cause fuel starvation. Therefore, always drain the fuel selector sump (as described in Section VII) at each preflight inspection.

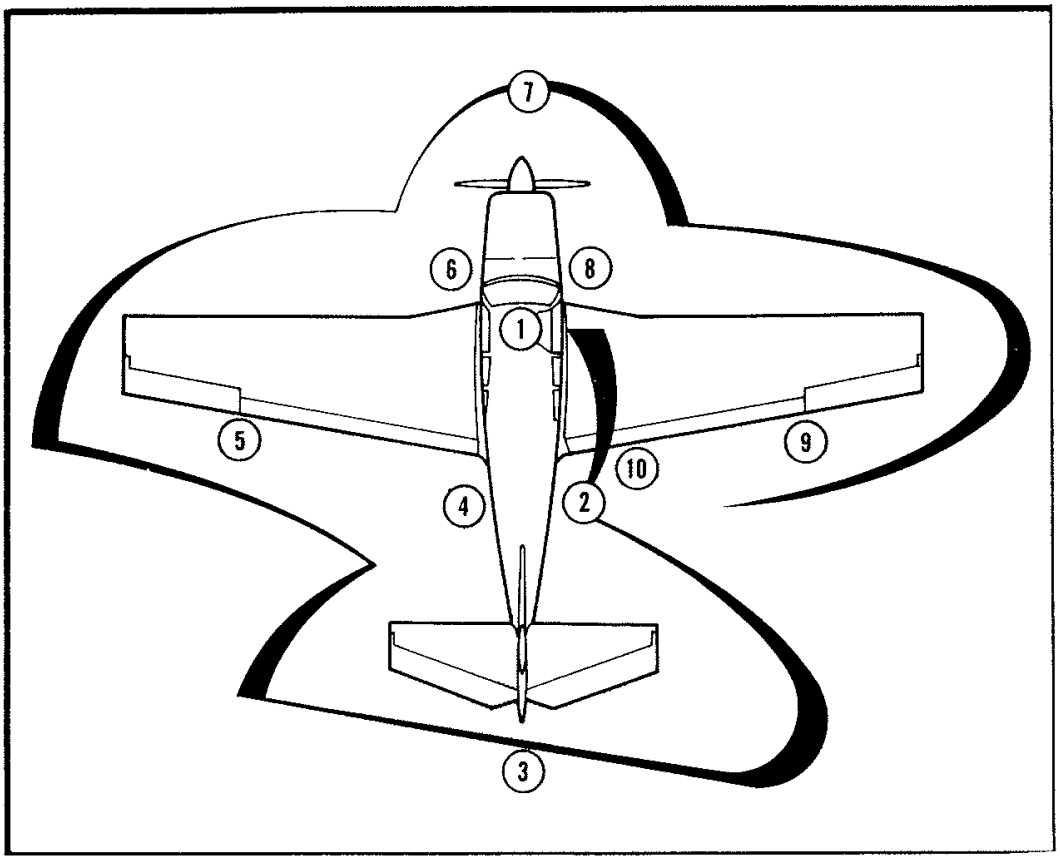


FIGURE 3-1. PREFLIGHT WALK AROUND DIAGRAM

PREFLIGHT CHECK

1. Ignition Switch--OFF.
   Master Switch--ON to check outside lights, then OFF.
   Fuel Selector Drain--Selector handle on R; pull ring and hold for five seconds. Repeat procedure with selector handle on L.

2. Instrument Static Port--UNOBSTRUCTED.
   Tail Tiedown--REMOVE.

3. Empennage--CHECK.
   Remove all ice, snow, or frost.

4. Tail Cone Access Door--SECURE.
Instrument Static Port--UNOBSTRUCTED.
Static System Drain--CHECK.

5. Wing Skins--CHECK.
Flap and Attach Points--CHECK.
Aileron and Attach Points--CHECK.
Wing Tip and Navigation Light--CHECK.
Remove all ice, snow, or frost.

6. Left Wing Leading Edge--CHECK.
Pitot Tube and Stall Switch Vane--UNOBSTRUCTED.
Fuel Tank--CHECK QUANTITY; SECURE CAP.
Chock and Tiedown--REMOVE.
Left Main Gear Shock Discs and Tire--CHECK.
Fuel Tank Sump Drain--SAMPLE.
Pitot System Drain--CHECK.
Tank Vent--UNOBSTRUCTED.
Fuel Selector Drain Valve--CLOSED.
Windshields--CLEAN.
Left Side Engine Cowl Fasteners--SECURE.

7. Propeller--CHECK for nicks and cracks.
Forward Engine Components--CHECK starter, alternator belt, etc.
Induction Air Filter--CHECK clean and sealed.
Landing Light--CHECK.
Nose Gear--CHECK tire; check for towing damage.
Shock Discs--CHECK.

8. Right Side Engine Cowl Fasteners--SECURE.
Engine Oil Level--CHECK (full for extended flight).
Windshield--CLEAN.

Fuel Tank Sump Drain--SAMPLE.
Tank Vent--UNOBSTRUCTED.
Chock and Tiedown--REMOVE.
Right Main Gear Shock Discs and Tire--CHECK.
Fuel Tank--CHECK QUANTITY; SECURE CAP.

9. Right Wing Leading Edge--CHECK.
Wing Skins--CHECK.
Wing Tip and Navigation Light--CHECK.
Aileron and Attach Points--CHECK.
Flap and Attach Points--CHECK.
Remove all ice, snow, or frost.

10. Baggage Door--SECURE.

BEFORE STARTING

After everyone has entered the aircraft, close and latch the door. Be sure all baggage is secure and that all necessary charts, computers, and other loose items are aboard and securely stowed so that they will not be thrown about the cabin if rough air is encountered in flight. See that all safety belts are fastened and that the seats are adjusted and locked in comfortable positions. With the pilot's seat properly set, you should be able to fully deflect all flight controls. Be sure there is a flashlight aboard for night flights.

BEFORE STARTING CHECK

1. Fuel Selector Handle--SET for fuller tank.

2. Parking Brake Control--PULL ON.

3. Ignition and Master Switches--OFF.

4. Carburetor Heat--OFF.

5. Landing Gear Switch--DOWN.
6. Mixture Control--IDLE CUTOFF.
7. Propeller--HIGH RPM.
8. Throttle--CLOSE.
9. Boost Pump--OFF.
10. All External Light--OFF.
11. Radios--ALL OFF.
12. Cabin Heat--OFF.
13. Main Circuit Breaker Panel--CHECK.

STARTING

Before starting the engine, make sure the surrounding area is clear. It is good practice to call "CLEAR" before engaging the starter, and to direct the propeller blast to an open area before running up the engine. To prevent propeller damage, keep engine RPM low when operating on loose gravel.

The engine will require some priming for smooth starting. The standard fuel system does not incorporate a separate priming system; priming is accomplished by pumping the throttle with the electric fuel pump turned on and the mixture control lever in the FULL RICH position. For normal starts, pump the throttle twice. A cold engine will require three or more "priming shots" depending upon the ambient temperature.

The starting checklist is recommended for normal starting procedures; however, under extreme climatic conditions, alter the starting procedure to accommodate existing conditions. If the engine does not start after 10 or 15 seconds of cranking, discontinue cranking and allow the starter to cool for approximately five minutes before cranking again. Allowing the starter to cool intermittently will prolong starter life.

The engine is air-pressure cooled and depends on the forward speed of the aircraft to maintain proper cooling. Particular care is necessary, therefore, when operating the engine on the ground. To help prevent overheating, always head the aircraft into the wind and avoid prolonged engine ground operation.

STARTING CHECK

1. Master Switch--ON.

2. Fuel Quantity Indicators--CHECK for conformity to observed quantity.

3. Annunciator Lights--PRESS to TEST.

4. Landing GEAR DN Light--GREEN.

5. Electric Fuel Pump--ON.

6. Mixture Control--Open to FULL RICH.

7. Throttle--PUMP TWICE to prime engine; then OPEN approximately one-quarter.

8. Ignition Starter Switch--turn to "START" and PUSH forward. When engine starts, release to "BOTH".

11. Oil Pressure Gage--25 PSI MIN (If there is no pressure indication within 30 seconds, PULL mixture control to IDLE CUTOFF and check oil system.)

12. Carburetor Heat--ON momentarily to check operation. (RPM should drop.)

    CAUTION: Limit the use of carburetor heat during ground operation to the time required to make sure the system is functioning properly. Heated carburetor air does not pass through the air filter; consequently, dust, dirt, and foreign substances can be drawn into the engine to cause accelerated cylinder and piston ring wear.

13. Fuel Pressure Gage--GREEN ARC.

14. Lights--As required.

15. External lights--ON as required.

16. Pitot Heater--CHECK and note ammeter deflection.

17. Radios--ON and CHECK.

18. Stabilizer Trim Indicator--TAKEOFF.

19. Fuel Selector Handle--CHECK right and left.

Flooded-Engine Clearing

1. Throttle--FULL OPEN.

2. Mixture Control--IDLE CUTOFF.

3. Electric Fuel Pump--OFF.

4. Ignition Starter Switch--turn to "START" and PUSH forward.

5. Throttle--RETARD when engine starts.

6. Mixture Control--Open slowly to FULL RICH.

Cold-Weather Starting

The starting procedure for a cold engine is the same as the normal starting procedure, except that additional priming (mixture control set at FULL RICH) may be necessary. During extremely cold weather it is advisable to preheat the oil and engine compartment with ground heaters.

Hand Cranking

Hand cranking is not recommended.

WARMUP & TAXIING

Allow the engine to warmup at 1000 to 1200 RPM; normally, taxiing will sufficiently warm the engine. The engine is warm enough for takeoff when it will develop full RPM and when the throttle can be opened without backfiring, skipping, or a reduction in oil pressure. Release the parking brake, and as the aircraft moves forward apply the toe brakes lightly to check brake effectiveness. Nose wheel steering, through rudder pedal action, is ordinarily sufficient for ground maneuvering. But, when necessary, make tighter turns by applying inside braking.

> CAUTION: Never rely on the retraction safety switch to keep the electric gear extended while taxiing, taking off, or landing. Always check the electric gear switch position.

Taxi with the mixture FULL RICH and the propeller at HIGH RPM to prevent engine overheating. Avoid prolonged ground operation at low RPM that will tend to foul the spark plugs.

> WARNING: While taxiing before takeoff, make sure that the Positive Control system is functioning normally and that the gyro instruments have erected properly.

The control wheel will tend to move in the opposite direction from the taxi turn when P.C. is working properly. The absence of flight control movement, or extreme control movement in either direction without prompt return to neutral, indicates a P.C. malfunction that should be corrected before flight. Taxi turns also present an opportunity to check the directional gyro for proper indication. The turn coordinator should indicate a bank in the direction of the turn.

Before runup, head the aircraft into the wind and center the nose wheel. It is always a good practice to stop the airplane with the nose wheel centered, since running up the engine or starting to taxi with the nose wheel in a cocked position imposes high side loads on the nose gear.

Minimize engine ground operation to prevent overheating. Monitor cylinder head and oil temperatures. Check the propeller governing system by advancing the throttle to 1700 RPM; then, pull the propeller control full aft (decrease RPM). As soon as a 100 RPM drop is noted, return the propeller control to FULL INCREASE RPM. In cold weather, repeat the cycle two or three times to flush the system with fresh, warm oil. Then, check R and L magnetos, returning the switch to BOTH between checks. Neither magneto should drop off more than 125 RPM when operated individually nor should the difference between the two exceed 50 RPM. With this check completed, slowly close the throttle to 1000-1200 RPM and complete the before-takeoff check.

BEFORE-TAKEOFF CHECK

1. Flight Controls--CHECK for unrestricted travel.
2. Fuel Selector Handle--SET for fuller tank.
3. Altimeter--SET to field elevation. (Obtain tower or weather station barometric pressure; check altimeter barometric pressure to determine deviation.)
4. Directional Gyro--SET to magnetic compass.
5. Flight Instruments--CHECK.
6. Engine Instruments--CHECK.
7. Clock--SET and wind as needed.
8. Stabilizer Trim--SET for TAKEOFF.
9. Propeller--CYCLE and CHECK at 1700 RPM.
10. Magnetos--CHECK at 1700 RPM.
11. Wing Flaps--SET for TAKEOFF or as desired.
12. Electric Fuel Pump--ON. (Check rise in fuel pressure.)
13. Seats--LOCKED.
14. Seat Belts--FASTENED.
15. Door and Pilot Window--LATCHED closed.

Before applying power for takeoff, quickly recheck for:

1. Propeller--FULL INCREASE.

2. Trim Indicator--TAKEOFF.

3. Flap Indicator--TAKEOFF or as desired.

4. Fuel Selector Handle--FULLER TANK.

   WARNING: Do not change fuel tanks immediately before takeoff.

5. Carburetor Heat--OFF.

Proceed with takeoff as soon as the above checklist is complete. If it is necessary to hold for clearance instructions, run the engine at 1400-1500 RPM to insure proper cooling and to minimize spark plug fouling.

NOTE: During takeoff from high elevation airports or during climb, engine roughness or loss of power may result from over-richness. In such a case adjust mixture control only enough to obtain smooth operation--not for economy. Observe instruments for temperature rise.

FLIGHT OPERATIONS

TAKEOFF

When ready for takeoff, apply power slowly to avoid picking up loose stones, etc., with the propeller. (On short fields you may prefer to hold the brakes until gaining full power.) As the aircraft accelerates continue increasing power until reaching full throttle. Have the control friction lock tight enough to prevent throttle creep.

As speed increases during the takeoff roll, apply back pressure on the control wheel at about 65-75 MPH (56 to 66 Knots).

The aircraft will tend to rock into a nose-high attitude as it breaks ground. To compensate for this tendency, slowly relax some of the elevator back pressure as the nose wheel leaves the runway. Keep the nose on the horizon just after the aircraft breaks ground to allow smooth flight from the runway without an abrupt change in pitch attitude.

When making a cross-wind takeoff, hold the nose wheel on the runway longer and accelerate to a higher speed than normal. Pull up abruptly to avoid contact with the runway while drifting. When clear of the ground, make a coordinated turn into the wind to correct for drift.

Retract the landing gear only when safely airborne and in good control. Retract the flaps when the aircraft has cleared all obstacles and has gained an indicated airspeed of about 80 to 90 MPH (70 to 78 Knots).

After takeoff:

(1) Apply the brakes to stop wheel rotation.
(2) Retract the gear.
(3) Retract the flaps.
(4) Establish climb-out attitude.
(5) Turn off the electric fuel pump at a safe altitude and check the fuel pressure indication to insure that the engine-driven fuel pump is maintaining fuel pressure.

CLIMB

An enroute climb speed of 115-120 MPH (100-104 Knots) IAS is recommended for improved engine cooling and forward visibility. The speed for maximum rate of climb is a straight-line variation from 100 MPH (87 Knots) IAS at sea level (decreasing approximately one

MPH per 1000 feet increase in altitude) to 91 MPH (79 Knots) IAS at 10,000 feet. The speed for maximum angle of climb (for obstacle clearance at full power, gear and flaps up) is about 80 MPH (70 Knots) IAS at full power. The recommended power setting for normal climb is 2600 RPM and 26 inches manifold pressure.

Manifold pressure will drop with increasing altitude at any throttle setting. Power can be restored by gradually opening the throttle until reaching full throttle.

> WARNING: Do not fly this aircraft into known icing conditions.

Under certain moist atmospheric conditions, it is possible for ice to form in the induction system, even in summer weather. The formation of ice in the induction system will be reflected by a drop in manifold pressure. When an unaccountable loss of manifold pressure is noted, apply full carburetor heat and open the throttle to the limit of manifold pressure. The use of carburetor heat may cause the engine to run rough; if so, lean the mixture until the engine smooths.

> WARNING: Do not use partial carburetor heat unless the aircraft is equipped with a carburetor air temperature gage. Moisture in crystal form that would ordinarily pass through the induction system as crystals can be melted with application of partial carburetor heat. This moisture in turn can form carburetor ice due to the temperature drop as the air passes through the carburetor venturi. Therefore, when applying carburetor heat, always pull the control FULL ON. When turning carburetor heat OFF, move the control to the FULL OFF position.

After establishing climb power and trimming the aircraft for climb, check to insure that all controls, switches, and instruments are set and functioning properly.

CRUISE

Careful and detailed flight planning for each trip will increase operating efficiency. The weather, route, load and starting and arrival time will affect altitude selection and over-all flight efficiency.

The performance tables in Section VI will aid in selection of optimum cruise power settings. Cruise power is that portion of the power spectrum where the mixture may be leaned. Leaning is limited to 75 percent power or less for aircraft not equipped with an EGT gage. Leaning above 75 percent power may cause detonation and engine damage unless exhaust gas temperature is maintained 200°F below peak EGT on the rich side. Monitor cylinder head temperature when leaning. (Ref. Service Instruction Lycoming No. 1094B).

Upon reaching cruise altitude, allow acceleration to cruise airspeed, then trim the aircraft for level flight, reduce manifold pressure and RPM to desired cruise power. When cruising at 75 percent power or less, lean the mixture once cruise power is established. For best economy, slowly pull the mixture control lever toward the lean position, continue leaning until the engine runs rough. Then, enrich the mixture until the engine runs smooth. For increased power, enrich the mixture, increase RPM, advance the throttle, and repeat the leaning procedure.

CAUTION: Do not lean the mixture beyond 200°F below peak EGT on the rich side at power settings above 75 percent rated power. In selecting a cruise RPM, the engine must not be continuously operated within the range of 2000 to 2250 RPM. Recommended cylinder head temperature for continuous cruise operation is 400°F or less.

Very exacting fuel-air mixtures can be selected by observing the optional exhaust gas temperature gage (EGT) while adjusting the mixture control. Operate the mixture control slowly to allow for the slight lag in the EGT indicator.

For best economy below 75 percent rated power, lean the mixture by pulling the mixture control lever aft until the EGT indicator shows a peak (maximum) temperature and starts to decrease. Then, enrich the mixture by pushing the control lever forward until the temperature drops 25°F (one mark on the gage) from peak temperature.

For best power (maximum airspeed) below 75 percent power, lean the mixture by pulling the mixture control lever aft until the EGT indicator shows a peak (maximum) temperature, and then enrich the mixture by pushing the control lever forward until the EGT shows a drop of 100°F (four marks on the gage) below the peak temperature.

When making power changes it is advisable to always increase RPM before increasing manifold pressure, and to decrease manifold pressure before reducing RPM. Always stay within the established operating limits, and always operate the controls slowly and smoothly.

Aerodynamic efficiency is optimum in the normal indicated cruise ranges. The airspeed indicator is marked with a green arc from 64 to 175 MPH (56 to 152 Knots)

and a yellow arc from 175 to 200 MPH (152 to 174 Knots). The yellow arc indicates the range of airspeeds in which you must exercise caution when flying in rough air or gusts. (Rough air is defined as flight in turbulence of a degree that is uncomfortable to the pilot and passengers.) Reduce speed when encountering rough air or gusts, and operate in the airspeed indicator green arc range.

> WARNING: Operate this aircraft as a Normal Category airplane in compliance with the operating limitations stated in the form of placards, markings, and manuals. Do not attempt maneuvers involving full application of rudder, elevators, or ailerons above 132 MPH (115 Knots) CAS. No aerobatic maneuvers including spins are approved.

STALLS

The stall characteristics of the airplane are conventional and rapid recovery from a stall is affected by releasing elevator back pressure and applying power. Power-off stall speeds at various bank angles are presented in Section VI.

It is important to remember that while stalls are a permissible maneuver; they should not be practiced to learn how to stall the airplane but, rather, to learn how to recognize an incipient stall and to take prompt corrective action before the aircraft completely stalls.

Turn on the electric fuel pump prior to practicing stall recovery and apply full carburetor heat before reducing power. For power-on stalls, the FAA recommends about 65 percent power. Enter stalls only from coordinated flight, regardless of the method of entry or airplane configuration.

Flight controls will remain effective throughout all normal stall maneuvers. Approach the stall slowly, but positively,

by reducing airspeed with about one mile an hour decrease per second, until detecting the first evidence of the approaching stall. The stall warning horn will give the first indication of the approaching stall and this may be followed by downward pitching, aerodynamic buffeting, rapid decay of control effectiveness, and/or a rapid loss of altitude with the control wheel aft. Upon recognizing the approaching stall, recover by releasing elevator back pressure and applying power.

> WARNING: Do not deactivate the stall warning horn when practicing stalls; the stall warning horn is required aircraft equipment.

If stall recovery is not initiated during the approach to the stall, the airplane will stall and the nose will pitch downward. Recovery from the complete stall is conventional, with release of elevator back pressure and the addition of power.

Holding the aircraft in a stall with the control wheel fully aft may result in a roll to one side or the other, unless precise control coordination is maintained. The rudder may prove more effective than the ailerons in preventing the roll; however, recovery from the complete stall and possible roll is again achieved with normal use of the controls. Delay the application of power, to prevent build-up of excessive airspeed, if the aircraft assumes a steep nose-down attitude.

SPINS

Intentional spins are not permitted in this airplane; however, if stall recovery is delayed or if the airplane is held in the stall, in an uncoordinated manner, the airplane will likely go into a spin. A spin is a stall combined with rotation, with the airplane rotating downward in a descending corkscrew-like path. The outside wing in the rotation moves fastest and produces some effective lift, while the wing toward the inside of

the spin moves slower and produces little or no effective lift. A spin is generally caused by an uncoordinated yawing of the aircraft while in a stalled condition. Should a spin occur employ the following recovery procedures immediately:

1. Neutralize the ailerons and close the throttle.

2. Briskly apply full rudder against the spin.

3. Follow with rapid forward movement of the control wheel to pitch the nose down.

4. Hold the rudder in full antispin configuration until rotation stops.

5. Recover from resulting dive.

NOTE: If spin recovery is delayed until the aircraft has made one complete turn in the spin, rotation may continue up to one additional turn after antispin controls are fully applied.

WARNING: Up to 2000 feet of altitude may be lost in a one-turn spin and recovery; therefore stalls at low altitude are extremely critical.

On entering a spin, the aircraft will roll, very much like a barrel roll. The wings will be near vertical at about the first quarter turn of the spin. At about the half turn point, the wings are approaching level but, now, the nose will be very low--approaching vertical. After one full turn has been completed, the nose will come up somewhat, but will remain well below the horizon. The rate of rotation during the first portion of the spin is quite rapid and occupants of the aircraft will likely become disoriented. On subsequent turns, the wings may be near level or slightly lower toward the direction of the spin. The nose

will continue to be pointing more nearly toward the ground than the horizon, as the airplane revolves and descends. As the spin progresses, it may enter into what is referred to as a flat spin. When the spin becomes flat, the aircraft nose comes up and remains more on the horizon, with possibly some shallow up and down oscillation. The rate of descent and rate of rotation both become slower. An aircraft in a flat spin becomes stabilized into autorotation and once in this condition, the controls become ineffective and recovery is very difficult or may not be possible.

In complying with the FAA Regulation for Normal Category aircraft, it has been demonstrated that the airplane will recover after delayed stall recovery up to and including one-turn spins.

This one-turn "margin of safety" is designed to provide adequate controllability when recovery from a stall is delayed. The one-turn "margin of safety" is jeopardized if the airplane is not recovered when the first evidence of a stall is detected.

POSITIVE CONTROL

Positive Control will hold an approximate heading over a period of time; however, it will not hold an exact heading without the installation of a magnetic heading lock. To check for a P.C. malfunction while in flight, first establish a moderate bank; then, release the controls to see if the aircraft will return to straight wings-level flight as indicated by the artificial horizon. Repeat the procedure with a turn in the opposite direction. Sluggish, erratic, or incomplete bank recovery warns of a malfunction in the P.C. system.

> WARNING: Thoroughly familiarize yourself with the flight characteristics of the aircraft with Positive Control inoperative. This can be done by simply squeezing the cutoff trigger while making turns

and maneuvers. Check the P.C. system frequently during each flight to insure that it is functioning properly, particularly when IFR or marginal weather may be encountered.

In the event of a complete engine power loss, P.C. will continue to operate as long as the propeller is windmilling at 1000 RPM or more. Loss of vacuum (indicated by a LO vacuum annunciator light) will automatically make the P.C. system inoperative. However, the turn coordinator will continue to operate on electrical power. The turn coordinator can be used as a flight reference if other gyro instruments become inoperative.

FUEL MANAGEMENT

Proper fuel management during flight will help maintain lateral trim and will also serve as a fuel quantity check. After takeoff with both tanks full, use fuel from one tank for one hour; then, switch to the other tank and note the time. Use all the fuel from the second tank. The remaining fuel endurance in the first tank can be calculated from the time it took to deplete the second tank, less one hour. You must remember, however, that this endurance calculating procedure can be relied upon only if power and mixture remain the same and an allowance is made for the extra fuel used during climb. For estimation purposes, consider fuel consumption during a full-power climb to be 40 percent higher than that of best-power cruise, and 50 percent higher than that of best-economy cruise.

CAUTION: Do not allow the engine to lose power or quit before switching fuel tanks. A red "Fuel Press" annunciator will illuminate when pressure drops to the minimum allowable indicating fuel exhaustion or engine driven fuel pump malfunction. Switch fuel tanks or turn on boost pump as needed. If a tank runs dry and the engine quits, retard the

throttle before restarting. Restarting with an advanced throttle may cause engine overspeeding that can lead to mechanical malfunction.

INFLIGHT RESTARTING

1. Propeller--HIGH RPM.
2. Fuel Selector--Fuller tank.
3. Mixture Control--IDLE CUTOFF.
4. Boost Pump--ON.
5. Throttle--OPEN 1/4 travel.
6. Ignition Switch--BOTH.
7. Mixture Control--Move slowly and smoothly to FULL RICH.
8. Re-establish cruise power and RPM, then lean mixture.

LETDOWN

Plan your letdown well in advance of estimated landing time. Generally, a power-on descent is most desirable. A gradual rate of descent at cruising speed permits power settings sufficiently high to maintain proper engine temperatures and to prevent spark plug fouling. Sudden power reductions at higher airspeeds can damage the engine by causing it to cool too rapidly.

> WARNING: Apply full carburetor heat when reducing power for descent or landing.

Establish a gradual letdown by reducing power below cruise while maintaining cruise airspeed throughout the descent. Monitor cylinder head and oil tempera-

tures throughout descent to guard against over cooling. Oil in the oil cooler can congeal very rapidly after a power reduction when flying in cold weather.

CAUTION: Do not lower gear above 120 MPH (104 Knots) IAS. Do not lower flaps above 125 MPH (109 Knots) IAS. Do not exceed 125 MPH (109 Knots) IAS with the flaps down or 120 MPH (104 Knots) IAS with gear down.

BEFORE-LANDING CHECK

1. Seat Belts--FASTENED.
2. Fuel Selector Handle--SET for fuller tank.
3. Electric Fuel Pump--ON.
4. Mixture Control--FULL RICH.
5. Carburetor Heat--FULL ON.
6. Airspeed--REDUCE to 120 MPH (104 Knots).
7. Propeller--FULL INCREASE.
8. Landing Gear--DOWN and LOCKED; green annunciator light on.
9. Flaps--As required.
10. Trim--As required.

LANDING

Ordinarily, you should complete the Before-Landing Check on the downwind leg. To allow for a safe margin above stall speed throughout approach, hold airspeed above 90 MPH (78 Knots) until the flaps are lowered. Degree of flap deflection needed will vary

according to landing conditions, but for most landings you should lower flaps about half way just prior to turning on to base leg. Extend flaps as required on final approach to adjust for variations in wind, glide angle, and other variables.

> WARNING: The stall warning horn and the landing gear warning horn are inoperative when the master switch is in the OFF position.

On final, trim the aircraft to fly hands-off at an approach speed of about 80 MPH (70 Knots). As you cross the runway end markers, reduce power to idle. Slow the rate of descent by increasing back pressure on the control wheel until the aircraft settles on the runway in a slightly nose-high attitude. (When high, gusty winds prevail, or when landing crosswind, approach at a higher airspeed.) Slowly relax back pressure and gently lower the nose wheel to the runway after main gear contact so the nose gear steering system can be used to help control landing rollout direction.

> CAUTION: Do not allow the aircraft to touch down in a nose-low attitude or at too high an airspeed. Either of these conditions will allow the nose wheel to contact the runway first, which may cause the aircraft to porpoise and damage the gear.

Unless a short roll is necessary, you should allow the aircraft to slow to a moderate taxi speed before applying brakes. After leaving the runway, turn off the electric fuel pump, retract the flaps, and reset the trim to TAKEOFF. Hold taxi power setting between 1000 and 1200 RPM to permit uniform engine cooling.

Execute short-field landings with partial power and full flaps on final approach. Reduce power to idle during

flare-out, and touch down first on the main wheels before allowing the nose wheel to make contact. You may apply brakes as soon as all wheels are firmly on the ground. For maximum braking effect, raise the flaps and apply back pressure on the control wheel as you apply brakes. Do not skid the main wheels, as doing so will reduce braking effectiveness and damage the tires.

AFTER LANDING

1. Electrical Fuel Pump--OFF.
2. Carburetor Heat--OFF.
3. Wing Flaps--RETRACT.
4. Stabilizer Trim--TAKEOFF.
5. Throttle--1000 to 1200 RPM.

SHUTDOWN CHECK

1. Throttle--IDLE at 1000 to 1200 RPM until cylinder head temperature starts to drop.
2. Radios--OFF.
3. Electrical Switches--OFF.
4. Mixture Control--IDLE CUTOFF.
5. Throttle--RETARD as engine stops firing.
6. Ignition Switch--OFF when propeller stops.
7. Parking Brake--Set (for short-time parking).
8. Trim--TAKEOFF.
9. Flaps--RETRACTED.

10. Master Switch--OFF.

11. Control Wheel--LOCK with seat belt.

12. Overhead Air Scoop--CLOSED.

13. Wheel Chocks and Tiedown--As required.

SECTIONS IV. & V.
FAA APPROVED
AIRPLANE FLIGHT MANUAL

SECTION IV.
AIRCRAFT LIMITATIONS AND OPERATIONS

MOONEY MODEL M20C
RANGER

MOONEY AIRCRAFT COPPORATION

SERIAL NO.: _____

REGISTRATION NO.: _____

This Manual Must Be Kept Onboard The Airplane At All Times

APPROVED BY: Don P. Watson

CHIEF, ENGINEERING & MANUFACTURING BRANCH,
SOUTHWEST REGION, FEDERAL AVIATION ADMINISTRATION

DATE: Dec. 2, 1974

LOG OF REVISIONS

LETTER	PAGE	DATE	APPROVED

OPERATING LIMITATIONS

The following limitations must be observed in the operation of this airplane:

AIRSPEED LIMITATIONS

Never Exceed Speed	200 MPH (174 Knots) CAS
Max Structural Cruising Speed	175 MPH (152 Knots) CAS
Max Maneuvering Speed . .	132 MPH (115 Knots) CAS
Max Gear Operating Speed .	120 MPH (104 Knots) CAS
Max Gear Extended Speed . .	120 MPH (104 Knots) CAS
Max Flap Operating Speed .	125 MPH (109 Knots) CAS

AIRSPEED INSTRUMENT MARKINGS

Radial Red Line . . . . . 200 MPH (174 Knots) CAS
(Denotes never exceed speed which is the maximum safe airspeed)

Yellow Arc . . . 175 to 200 MPH (152 to 174 Knots) CAS
(Denotes range of speeds in which operations should be conducted with caution and only in smooth air)

Green Arc . . . . 70 to 175 MPH (61 to 152 Knots) CAS
(Denotes normal operating speed range)

White Arc . . . . 63 to 125 MPH (55 to 109 Knots) CAS
(Denotes speed range in which flaps may be safely lowered)

POWER PLANT

Engine . . . . . Lycoming Model 0-360-A1D

Engine limits for all operations . . . . . 180 BHP, 2700 RPM

Fuel . . . . . 100/130 octane aviation gasoline

Propeller . . . . . Hartzell Constant Speed
Hub HC-C2YK-1B
Blade 7666A-2
Pitch Setting at 30-inch station: High $29^{O} \pm 2^{O}$;
Low $13^{O} \pm 0^{O}$

POWER PLANT INSTRUMENTS

Tachometer

Radial Red Line (Rated) . . . . . .2700 RPM
Green Arc--Narrow (Rated operating range) . . . . . 2300-2700 RPM
Green Arc--Wide (Recommended operating range) . . . . . 2300-2500 RPM
Red Arc--Wide (No continuous operation in this range) . . . . . 2000-2250 RPM

Cylinder Head Temperature

Radial Red Line (Maximum) . . . 500 DEG F
Green Arc (Operating range) 350-450 DEG F

Oil Pressure

Radial Red Line (Minimum idling) . . 25 PSI
Radial Red Line (Maximum) . . . . . 100 PSI
Green Arc (Operating range) . . 60 to 90 PSI
Yellow Arc (Idling range) . . . 25 to 60 PSI
Yellow Arc (Starting & warm-up range) . . . . . 90 to 100 PSI

Fuel Pressure

Radial Red Line (Minimum)	0.5 PSI
Radial Red Line (Maximum)	6.0 PSI
Green Arc--Wide (Normal operating range)	2.5 to 3.5 PSI
Green Arc--Narrow Operating range)	0.5 to 6.0 PSI

Oil Temperature

Radial Red Line (Maximum) . . .	245 DEG F
Green Arc (Operating range)	100 to 225 DEG F

OTHER INSTRUMENTS AND MARKINGS

Vacuum Warning Lights

HI Light	5.00 IN. Hg
LO Light	4.25 IN. Hg

Illumination of a HI or LO vacuum annunciator light indicates that the vacuum system has malfunctioned. The following equipment is vacuum operated:

1. Artificial horizon (if installed)
2. Directional gyro (if installed)
3. Turn coordinator (will operate electrically)
4. Positive control system.

WEIGHT & CENTER-OF-GRAVITY LIMITS

Maximum Gross Weight . . . . . 2575 LBS

Center of Gravity Limits (Gear Down):

Forward CG Limit (FUS STA & % MAC)
2100 LBS Most FWD . . . . . 42.0 IN. (15.0%)

2575 LBS Forward Gross . . 46.5 IN. (22.6%)

Aft CG Limit (FUS STA & % MAC)
All Weights . . . . . 49.0 IN. (26.8%)

MAC (Wing station 93.83) . . . . . 59.18 IN.

Datum (station zero) is the nose gear attaching bolt center line, which is 33 inches forward of the wing leading edge at wing station 59.25.

MANEUVERS

This airplane must be operated as a normal category airplane. Acrobatic maneuvers, including spins, are unauthorized.

> NOTE: Maneuvers involving approach to stalling angle or full application of elevator, rudder, or aileron should be confined to speeds below maneuvering speed. No snap maneuvers or whip stalls are approved at any speed. No inverted maneuvers are approved.

FLIGHT LOAD FACTORS

Maximum Positive Load Factor,
Flaps Up 3.8
Maximum Positive Load Factor,
Flaps Down (33^{O}) 2.0
Maximum Negative Load Factor,
Flaps Up 1.5

TYPES OF OPERATION

Do not operate in known icing conditions.

This is a normal category aircraft approved for VFR/IFR, day or night operations, provided the following instruments and equipment are installed and operating properly.

REQUIRED EQUIPMENT

VISUAL FLIGHT RULES -- DAY

Airspeed indicator
Altimeter
Magnetic direction indicator (mag compass)
Tachometer
Manifold pressure gage
Oil pressure gage
Oil temperature gage
Cylinder head temperature gage
Fuel quantity gage for each tank
Fuel pressure gage
Landing gear position indicator
Gear warning horn
Stall warning system
Master switch
Battery and alternator
Circuit breakers and fuses
Seat belts for all occupants
Emergency locator transmitter

VISUAL FLIGHT RULES -- NIGHT

All equipment and instruments specified for VFR -- day
Position lights
Electric landing light (if used for hire)
Anticollision light

INSTRUMENT FLIGHT RULES

All equipment and instruments specified for VFR -- night
Gyroscopic rate-of-turn indicator
Bank indicator
Sensitive altimeter adjustable for barometric pressure
Clock with sweep second hand
Artificial horizon
Directional gyro
Adequate power source for each gyro instrument
Two-way radio communications system and navigational equipment appropriate to the ground facilities to be used

NOTE: Caution should be exercised when installed communications equipment interrupts the navigation signal during transmissions.

OPERATING PROCEDURES

NORMAL

This airplane must be operated as a Normal Category airplane in compliance with the operating limitations stated in the form of placards, markings, and manuals. No acrobatic maneuvers, including spins, are approved.

The lateral stability augmentation system cutoff valve, located in the left hand grip of the pilot's control wheel, cuts off the system when depressed.

The roll-trim knob on the turn coordinator provides a command trim function. Rotation in a clockwise direction trims right; counterclockwise rotation trims left.

Circuit breakers are located on the right hand side of the co-pilot's instrument panel. The alternator circuit breaker is on the circuit breaker panel. Circuit breakers are push-pull or push-to-reset type.

A horn emitting an intermittent, then steady tone warns of approaching stall.

A horn emitting an intermittent tone warns of a retracted landing gear when power is reduced below 12 IN. Hg manifold pressure.

All warning devices are inoperative when the master switch is off.

Do not open storm window above 150 MPH (130 Knots).

Turn full carburetor heat on when reducing power for descent or landing.

To preclude fuel starvation, avoid extreme sustained side slips toward the tank in use when that tank contains less than 36 pounds of fuel.

Retract flaps after landing.

EMERGENCY

Emergency procedures are contained in the Emergency Procedures section of the Operator's Manual.

LOADING INFORMATION

It is the responsibility of the airplane owner and the pilot to insure that the airplane is properly loaded. Load the aircraft in accordance with the loading schedule.

> WARNING: See Weight & Balance Record for loading schedule.

The front seat positions can adversely affect CG limitations at the most rearward loading. Allowable baggage weight may be dictated by seat positions. Maximum allowable weight in the baggage compartment is 120 pounds.

> WARNING: Maximum allowable weight in the optional hatrack is 10 pounds. Carry only soft, light objects in the hatrack.

FAA APPROVED

SECTION V.
EMERGENCY OPERATION AND PROCEDURES

MOONEY MODEL M20C
RANGER
MOONEY AIRCRAFT CORPORATION

LOG OF REVISIONS

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EMERGENCY OPERATIONS & PROCEDURES

In case of engine fire, turn cabin heater off.

Turn carburetor heat FULL ON if icing conditions are inadvertently encountered.

WARNING: A discharged storage battery may prevent the gear from fully extending by electrical power.

EMERGENCY GEAR-EXTENSION

To manually extend the landing gear:

1. Pull landing gear actuator circuit breaker to OFF position.

2. Place gear switch in DOWN position.

3. Push handcrank engage lever forward to engage drive mechanism.

4. Crank handcrank clockwise to fully lower the gear. The gear is down-and-locked when the green light comes on. In case of electrical malfunction, check the visual gear-down indicator marks for alignment.

   CAUTION: Do not attempt to manually retract the electric landing gear.

   WARNING: Do not operate landing gear electrically with handcrank engaged.

POSITIVE CONTROL (LATERAL STABILITY AUGMENTATION SYSTEM)

The pilot can override the system at any time in the event of a P.C. malfunction. Complete disengagement may be accomplished by squeezing the cutoff trigger.

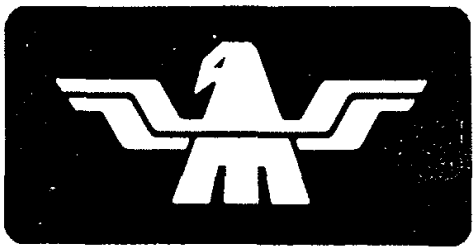
In the event of a partial or complete vacuum failure (indicated by a red light on the glareshield), the lateral stability augmentation system will automatically become inoperative.

ALTERNATOR POWER LOSS

Resetting the main alternator circuit breaker will usually restore an overloaded circuit. If after allowing the circuit breaker to cool, pressing the button a second time does not reactivate the circuit, the alternator circuit breaker must remain open and the alternator field circuit breaker must be pulled out to break the alternator excitation circuit.

If the red alternator annunciator light illuminates steadily, turn off all radio equipment and turn the master switch off and on to reset the voltage regulator. If the alternator light comes on again pull the alternator field circuit breaker out. All electrical equipment not essential for flight should be turned off and the flight terminated as soon as practical to correct the malfunction.

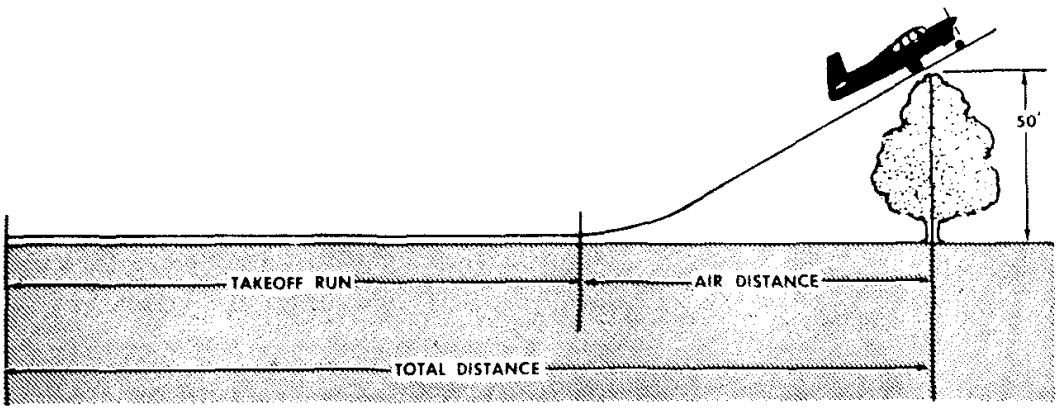
SECTION VI. PERFORMANCE



All performance tables and graphs are grouped in this section of the manual for quick and easy reference. This graphic information is presented to show performance that may be expected from the aircraft, and to assist you in planning your flights with reasonable detail and accuracy. All data has been compiled from test flights with the aircraft and engine in good operating condition while using average piloting techniques. Note that the cruise performance data (pages 6-8 thru 6-14) makes no allowance for wind and navigation errors. All performance charts and graphs are based on operation with no wind on level, paved runways. In using this data, allowances must be made for actual conditions.

A carefully detailed and analyzed flight plan will yield maximum efficiency . After making a flight plan based on estimates taken from the data in this section, you should check your actual performance and note the difference between your forecast conditions and actual flight performance so that your future estimates may be more accurate.

TAKEOFF DISTANCE (OVER-50 FOOT OBSTACLE)



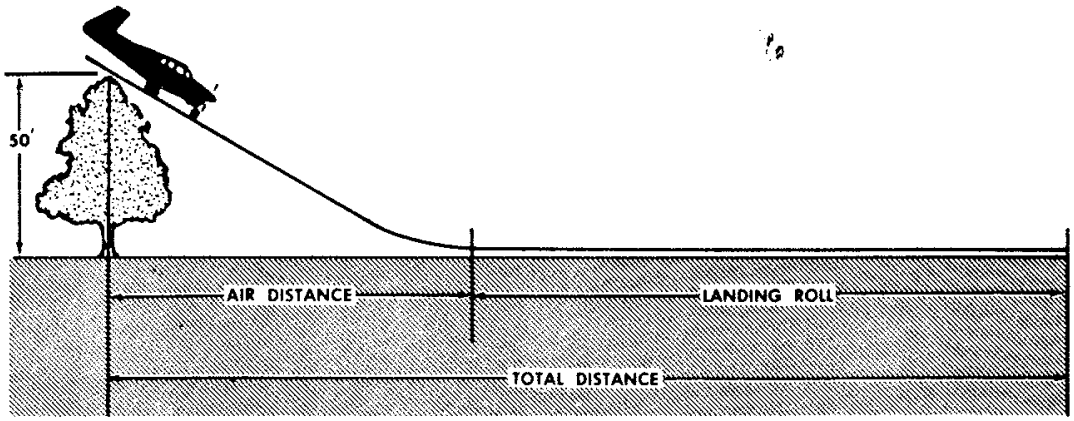
		TAKEOFF WEIGHT OF 2200 LBS			TAKEOFF WEIGHT OF 2575 LBS		
ALTITUDE IN FEET (MSL)	TEMP IN °F	TAKEOFF RUN (FEET)	AIR DISTANCE (FEET)	TOTAL DISTANCE (FEET)	TAKEOFF RUN (FEET)	AIR DISTANCE (FEET)	TOTAL DISTANCE (FEET)
SEA LEVEL	100°	745	545	1290	1030	730	1760
	59°	620	455	1075	815	580	1395
	20°	520	380	900	660	470	1130
2500	90°	900	660	1560	1345	960	2305
	50°	745	545	1290	1030	730	1760
	10°	615	450	1065	805	575	1380
5000	80°	1125	830	1955	1910	1365	3275
	41°	900	660	1560	1340	960	2300
	0°	740	540	1280	1000	715	1715

TAKEOFF CONDITIONS:

WING FLAPS -- TAKEOFF POSITION — HARD SURFACE RUNWAY

POWER -- 2700 RPM, MAX MANIFOLD PRESSURE — ZERO WIND

LANDING DISTANCE (OVER 50-FOOT OBSTACLE)



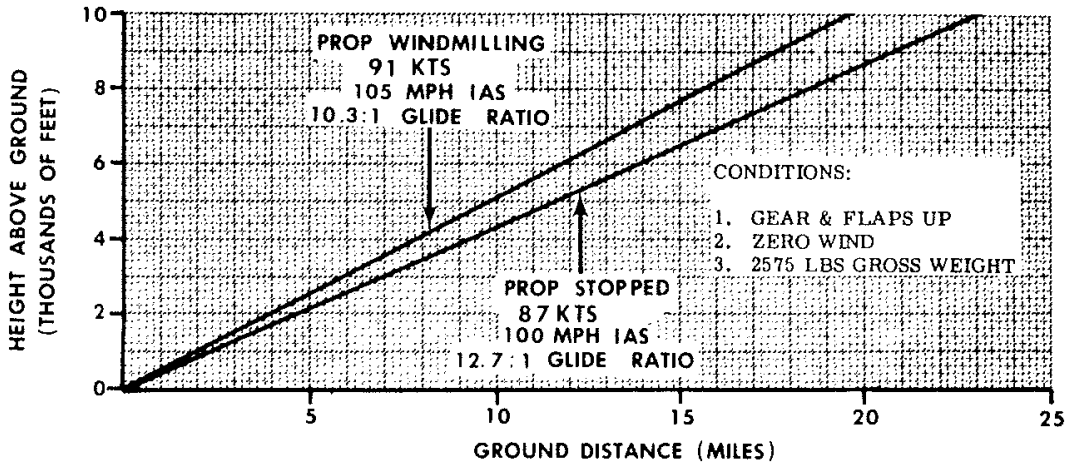
		LANDING WEIGHT OF 2200 LBS			LANDING WEIGHT OF 2575 LBS		
ALTITUDE IN FEET (MSL)	TEMP IN °F (STD)	AIR DISTANCE (FEET)	LANDING ROLL (FEET)	TOTAL DISTANCE (FEET)	AIR DISTANCE (FEET)	LANDING ROLL (FEET)	TOTAL DISTANCE (FEET)
SEA LEVEL	59°	815	550	1365	955	595	1550
2500	50°	835	595	1430	980	640	1620
5000	41°	870	640	1510	1015	690	1705
7500	32°	890	690	1580	1045	750	1795

LANDING CONDITIONS:

WING FLAPS -- FULL DOWN APPROACH IAS -- 80 MPH / 69 KTS

POWER OFF HARD SURFACE RUNWAY, ZERO WIND

GLIDE RANGE



CLIMB PERFORMANCE

STANDARD ALTITUDE (THOUSANDS OF FEET)

	RATE OF CLIMB (FPM AT 2575 LBS)	RATE OF CLIMB (FPM AT 2200 LBS)	BEST RATE OF CLIMB SPEED (MPH/KTS) CAS
18	25	230	82/71
17	70	270	83/72
16	115	315	84/73
15	155	355	85/74
14	200	395	86/75
13	245	430	87/76
12	285	480	88/77
11	325	525	89/77
10	370	570	90/78
9	410	610	91/79
8	450	650	92/80
7	495	690	93/81
6	530	735	94/82
5	580	780	95/83
4	620	825	96/83
3	670	870	97/84
2	710	915	98/85
1	750	960	99/86
SL	800	1000	100/87

CONDITIONS:

1. GEAR UP
2. FLAPS 15°
3. FULL RICH MIXTURE
4. FULL THROTTLE -- 2700 RPM

AIRSPEED CORRECTIONS

IAS MPH/KTS	CALIBRATED AIRSPEED (MPH/KNOTS)					
	0° FLAPS		15° FLAPS		33° FLAPS	
	POWER ON	POWER OFF	POWER ON	POWER OFF	POWER ON	POWER OFF
70/61	67/58	71/62	67/58	70/61	64/56	69/60
80/70	77/67	79/69	76/66	80/70	75/65	79/69
90/78	87/75	89/77	85/74	89/77	85/74	88/77
100/87	97/84	100/87	96/83	99/86	95/83	98/85
110/96	107/93	108/94	106/92	108/94	105/91	107/93
120/104	116/101	116/101	115/100	117/102	114/99	116/101
130/113	126/109	127/110	125/109	125/109	123/107	124/108
140/122	136/118	138/120				
150/130	146/127	147/128				
160/139	156/136	157/137				
170/148	166/144	167/145				
180/156	176/153	177/154				
190/165	186/162	188/163				
200/174	196/170	--				

NOTE: The calibrated airspeeds shown correct only for errors caused by the position of airspeed system components, and do not include any correction that may be required for individual airspeed indicators. Airspeed indicators may have errors up to 2.5 MPH (2.2 Knots).

STALL SPEEDS (POWER OFF)

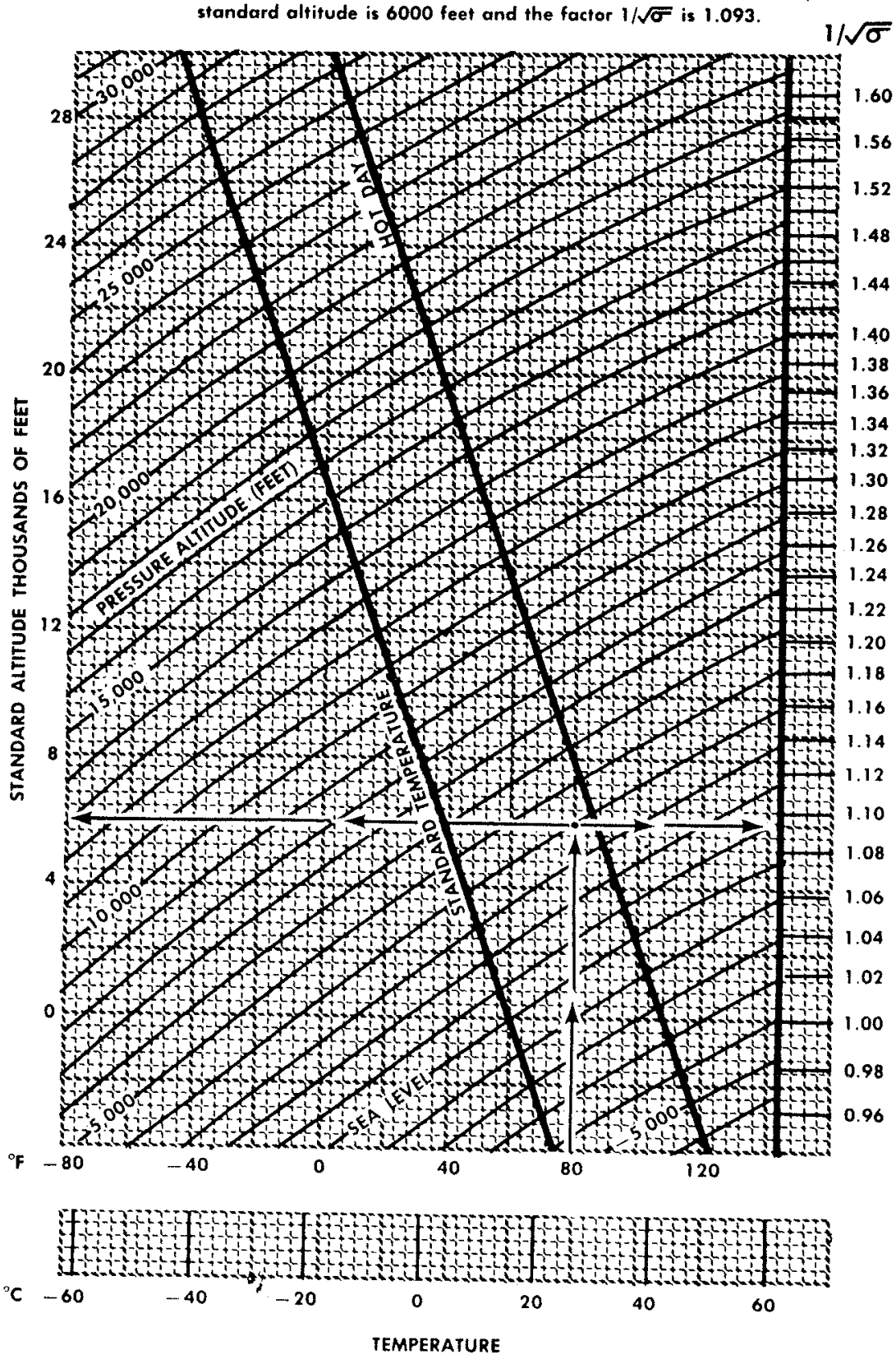
GROSS WEIGHT		ANGLE OF BANK			
		0°	20°	40°	60°
FLAPS & GEAR UP	MPH	67	69	78	96
	KNOTS	58	60	68	83
FLAPS 15° GEAR DOWN	MPH	64	67	76	94
	KNOTS	56	58	66	81
FLAPS 33° GEAR DOWN	MPH	57	61	69	90
	KNOTS	49	53	60	78

CONDITIONS:
1. GROSS WEIGHT
2. POWER OFF
3. IAS IN MPH & KTS
4. FORWARD CG

ALTITUDE CONVERSION

$TAS = CAS \times 1/\sqrt{\sigma}$

Example: If ambient temperature is 80°F and pressure altitude is 4000 feet, standard altitude is 6000 feet and the factor $1/\sqrt{\sigma}$ is 1.093.



CRUISE & RANGE DATA CONDITIONS:

1. All Cruise and Range Data tables allow for: a climb out at maximum available power, full-rich mixture, and best rate-of-climb airspeed to cruise altitude; a cruise to destination at the specified power and mixture setting; and a 45-minute fuel reserve at the same altitude and power setting. The data is also based on 52 gallons of usable fuel, standard atmosphere, and no wind. Take-off weight is 2575 pounds or 2200 pounds.

2. The data is taken from flight tests at full-rich mixture setting above 75 percent rated power and at a leaned mixture setting for cruise at 75 percent rated power or less. (See page 3-16)

3. When interpolating the cruise and range data for non-standard conditions, note that each $10^{O}F$ increase above standard temperature will cause a one percent reduction in horsepower, while each $10^{O}F$ decrease below standard temperature will cause a one percent increase in horsepower.

CRUISE & RANGE AT SEA LEVEL 59°F

MIXTURE SETTING:
1. Use FULL RICH mixture above 75 percent power. 2. Lean mixture at 75 percent power and below.

RPM	MAN PRES (IN. HG)	%BPH	FUEL (GAL/HR)	FUEL (LBS/HR)	TRUE AIRSPEED MPH/KNOTS 2575 LBS	TRUE AIRSPEED MPH/KNOTS 2200 LBS	ENDURANCE (HR:MIN)	RANGE (STAT MI) 2575 LBS	RANGE (STAT MI) 2200 LBS
2700	28.0	99.5	18.2	109.0	169/147	171/149	2:07	358	362
	27.0	94.9	17.2	103.3	166/144	168/146	2:16	377	382
	26.0	90.3	16.3	97.7	163/142	165/143	2:27	399	404
	25.0	85.7	15.3	92.1	159/138	161/140	2:38	422	428
2600	27.0	93.0	16.8	101.1	164/146	167/145	2:20	386	391
	26.0	88.5	15.9	95.5	161/140	163/142	2:31	407	413
	25.0	84.0	15.0	90.0	158/137	160/139	2:43	431	437
	24.0	79.5	14.1	84.5	154/134	157/136	2:56	457	463
2500	26.0	86.5	15.5	93.0	160/139	162/141	2:36	418	424
	25.0	82.1	14.6	87.6	156/136	159/138	2:49	442	448
	24.0	77.7	13.7	82.3	153/133	155/135	3:03	468	475
	23.0	73.3	9.2	55.4	149/130	152/132	4:53	734	745
2400	25.0	79.8	14.1	84.9	155/135	157/137	2:56	455	461
	24.0	75.5	9.5	57.1	151/131	154/134	4:43	717	728
	23.0	71.3	9.0	53.9	147/128	150/130	5:02	749	761
	22.0	67.0	8.4	50.6	143/124	147/128	5:25	783	798
2350	24.0	73.2	9.2	55.3	149/129	152/132	4:53	734	746
	23.0	69.0	8.7	52.2	145/126	148/129	5:14	766	780
	22.0	64.9	8.2	49.0	142/123	145/126	5:37	801	817
	21.0	60.7	7.7	45.9	137/119	141/123	6:03	838	857
1950	20.0	48.5	6.1	36.7	121/105	128/111	7:45	965	1001

CRUISE & RANGE AT 2500 FT, 50°F

MIXTURE SETTING:
1. Use FULL RICH mixture above 75 percent power. 2. Lean mixture at 75 percent power and below.

RPM	MAN PRES (IN. HG)	% BPH	FUEL (GAL/HR)	FUEL (LBS/HR)	TRUE AIRSPEED MPH/KNOTS 2575 LBS	TRUE AIRSPEED MPH/KNOTS 2200 LBS	ENDURANCE (HR:MIN)	RANGE (STAT MI) 2575 LBS	RANGE (STAT MI) 2200 LBS
2700	27.0	97.8	17.8	106.9	172/149	174/151	2:10	370	374
	26.0	93.2	16.9	101.3	168/146	171/149	2:20	390	395
	25.0	88.6	15.9	95.7	165/143	167/145	2:31	413	418
	24.0	84.0	15.0	90.0	162/141	164/143	2:43	437	443
2600	26.0	91.2	16.5	98.9	167/145	169/147	2:24	400	405
	25.0	86.8	15.6	93.4	164/143	166/144	2:35	422	428
	24.0	82.3	14.6	87.9	160/139	163/142	2:48	447	454
	23.0	77.7	13.7	82.3	156/136	159/138	3:02	475	482
2500	25.0	84.7	15.1	90.8	162/141	164/143	2:41	434	440
	24.0	80.3	14.2	85.5	158/137	161/140	2:54	459	466
	23.0	75.9	9.6	57.4	155/135	157/137	4:40	724	735
	22.0	71.4	9.0	54.0	151/131	154/134	5:00	757	771
2400	24.0	78.1	13.8	82.8	157/137	159/138	3:01	473	480
	23.0	73.8	9.3	55.8	153/133	156/136	4:49	739	752
	22.0	69.5	8.8	52.5	149/129	152/132	5:10	773	788
	21.0	65.2	8.2	49.3	145/126	148/129	5:34	810	827
2350	23.0	71.5	9.0	54.0	151/131	154/134	5:00	757	771
	22.0	67.3	8.5	50.9	147/128	150/130	5:22	791	807
	21.0	63.1	8.0	47.7	143/124	146/127	5:46	828	847
	20.0	58.9	7.4	44.6	138/120	142/123	6:14	869	890
1950	20.2	51.5	6.5	38.9	128/111	134/116	7:15	946	978

CRUISE & RANGE AT 5000 FT, 41°F

MIXTURE SETTING:
1. Use FULL RICH mixture above 75 percent power. 2. Lean mixture at 75 percent power and below.

RPM	MAN PRES (IN. HG)	%BPH	FUEL (GAL/HR)	FUEL (LBS/HR)	TRUE AIRSPEED MPH/KNOTS 2575 LBS	TRUE AIRSPEED MPH/KNOTS 2200 LBS	ENDURANCE (HR:MIN)	RANGE (STAT MI) 2575 LBS	RANGE (STAT MI) 2200 LBS
2700	24.5	89.3	16.1	96.5	169/147	172/156	2:29	414	420
	24.0	86.9	15.6	93.6	168/146	170/148	2:35	427	433
	23.0	82.3	14.6	87.9	164/143	166/144	2:48	453	460
	22.0	77.6	13.7	82.2	160/139	163/142	3:03	483	490
2600	24.5	87.3	15.7	94.0	168/146	170/148	2:34	425	431
	24.0	85.0	15.2	91.2	166/144	168/146	2:40	438	444
	23.0	80.5	14.3	85.7	162/141	165/143	2:53	464	471
	22.0	75.9	9.6	57.4	158/137	161/140	4:38	732	744
2500	24.5	85.1	15.2	91.4	166/144	169/147	2:40	437	443
	24.0	82.9	14.8	88.7	164/143	167/145	2:46	450	456
	23.0	78.5	13.9	83.3	160/139	163/142	3:00	477	484
	22.0	74.0	9.3	56.0	156/136	160/139	4:47	746	760
2400	24.5	82.8	14.8	88.5	164/143	167/145	2:46	450	457
	24.0	80.6	14.3	85.9	162/140	165/143	2:53	463	470
	23.0	76.3	13.4	80.6	158/137	162/140	3:07	491	499
	22.0	72.0	9.1	54.4	154/134	158/137	4:56	762	777
2350	24.0	78.2	13.8	82.9	160/139	163/142	3:01	479	486
	23.0	74.0	9.3	55.9	156/136	160/139	4:47	747	760
	22.0	69.8	8.8	52.7	152/132	156/136	5:07	780	796
	21.0	65.5	8.3	49.5	148/129	152/132	5:30	817	836
1950	20.0	53.0	6.7	40.1	132/115	139/121	7:00	942	974

CRUISE & RANGE AT 7,500 FT, 32°F

MIXTURE SETTING:
1. Use FULL RICH mixture above 75 percent power. 2. Lean mixture at 75 percent power and below.

RPM	MAN PRES (IN. HG)	%BPH	FUEL (GAL/HR)	FUEL (LBS/HR)	TRUE AIRSPEED MPH/KNOTS 2575 LBS	TRUE AIRSPEED MPH/KNOTS 2200 LBS	ENDURANCE (HR:MIN)	RANGE (STAT MI) 2575 LBS	RANGE (STAT MI) 2200 LBS
2700	22.5	82.8	14.8	88.5	168/146	171/149	2:46	455	462
	22.0	80.4	14.3	85.6	166/144	169/147	2:54	470	478
	21.0	75.7	9.5	57.2	161/140	165/143	4:37	740	754
	20.0	71.0	8.9	53.6	157/136	161/140	4:59	779	795
2600	22.5	80.9	14.4	86.2	166/144	169/147	2:52	467	474
	22.0	78.6	13.9	83.4	164/143	167/145	2:59	482	490
	21.0	74.0	9.3	55.9	160/139	163/142	4:45	754	768
	20.0	69.4	8.7	52.4	155/135	159/138	5:08	792	809
2500	22.5	78.8	14.0	83.7	164/143	167/145	2:59	480	488
	22.0	76.6	13.5	81.0	162/141	166/144	3:06	495	504
	21.0	72.1	9.1	54.5	158/137	162/141	4:54	769	784
	20.0	67.6	8.5	51.1	154/134	157/136	5:17	808	826
2400	22.5	76.7	13.5	81.0	162/141	166/144	3:06	495	504
	22.0	74.5	9.4	56.3	160/139	164/143	4:43	750	764
	21.0	70.1	8.8	53.0	156/136	160/139	5:04	786	803
	20.0	65.7	8.3	49.7	152/132	155/135	5:28	825	845
2350	22.5	74.3	9.4	56.2	160/139	164/143	4:44	751	765
	22.0	72.2	9.1	54.6	158/137	162/141	4:53	768	784
	21.0	67.9	8.6	51.4	154/134	158/137	5:15	805	823
	20.0	63.7	8.0	48.1	149/129	153/133	5:40	845	865
1950	19.9	54.9	6.9	41.5	137/119	144/125	6:42	933	965

CRUISE & RANGE AT 10,000 FT, 23°F

MIXTURE SETTING:
1. Use FULL RICH mixture above 75 percent power. 2. Lean mixture at 75 percent power and below.

RPM	MAN PRES (IN. HG)	%BPH	FUEL (GAL/HR)	FUEL (LBS/HR)	TRUE AIRSPEED MPH/KNOTS 2575 LBS	TRUE AIRSPEED MPH/KNOTS 2200 LBS	ENDURANCE (HR:MIN)	RANGE (STAT MI) 2575 LBS	RANGE (STAT MI) 2200 LBS
2700	20.2	74.7	9.4	56.4	164/143	168/146	4:40	753	768
	20.0	73.7	9.3	55.7	163/142	167/145	4:44	761	777
	19.0	68.9	8.7	52.1	158/137	162/141	5:08	803	821
	18.0	64.2	8.1	48.5	153/133	157/136	5:35	848	869
2600	20.2	72.9	9.2	55.1	163/142	166/144	4:48	768	784
	20.0	72.0	9.1	54.4	162/141	165/143	4:52	776	792
	19.0	67.3	8.5	50.9	157/136	161/140	5:16	818	837
	18.0	62.7	7.9	47.4	151/131	156/136	5:44	863	885
2500	20.2	71.0	9.0	53.7	161/140	164/143	4:57	784	801
	20.0	70.1	8.8	53.0	160/139	163/142	5:01	792	810
	19.0	65.6	8.3	49.6	155/135	159/138	5:26	835	855
	18.0	61.0	7.7	46.1	149/129	154/134	5:55	880	903
2400	20.2	69.0	8.7	52.2	159/138	162/141	5:07	802	820
	20.0	68.1	8.6	51.5	158/137	161/140	5:12	810	829
	19.0	63.7	8.0	48.2	153/133	157/136	5:37	853	874
	18.0	59.3	7.5	44.8	146/127	152/132	6:07	897	923
2350	20.2	66.9	8.4	50.6	156/136	160/139	5:19	822	841
	20.0	66.0	8.3	49.9	155/135	159/138	5:24	830	850
	19.0	61.7	7.8	46.7	150/130	155/135	5:50	873	896
	18.0	57.4	7.2	43.4	143/124	150/130	6:20	916	946
1950	19.8	56.8	7.2	42.9	142/123	149/129	6:26	922	954

CRUISE & RANGE AT 12,500 FT, 17°F

MIXTURE SETTING:
1. Use FULL RICH mixture above 75 percent power. 2. Lean mixture at 75 percent power and below.

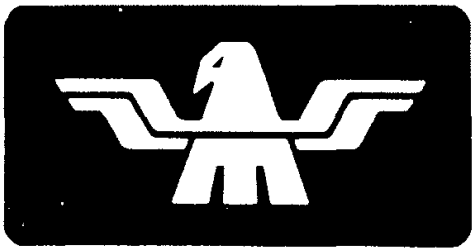
RPM	MAN PRES (IN. HG)	%BPH	FUEL (GAL/HR)	FUEL (LBS/HR)	TRUE AIRSPEED MPH/KNOTS 2575 LBS	TRUE AIRSPEED MPH/KNOTS 2200 LBS	ENDURANCE (HR:MIN)	RANGE (STAT MI) 2575 LBS	RANGE (STAT MI) 2200 LBS
2700	18.3	68.3	8.6	51.6	161/140	165/143	5:09	813	832
	18.0	66.8	8.4	50.5	159/138	164/143	5:17	827	847
	17.0	62.0	7.8	46.9	153/133	159/138	5:46	875	899
	16.0	57.2	7.2	43.2	145/126	153/133	6:20	922	958
2600	18.3	66.6	8.4	50.4	159/138	164/143	5:18	829	849
	18.0	65.2	8.2	49.3	158/137	162/141	5:26	843	864
	17.0	60.5	7.6	45.7	151/131	157/136	5:56	890	917
	16.0	55.8	7.0	42.2	142/123	151/131	6:31	935	977
2500	18.3	64.8	8.2	49.0	157/136	162/141	5:28	846	868
	18.0	63.5	8.0	48.0	155/135	160/139	5:36	860	883
	17.0	58.9	7.4	44.5	148/129	155/135	6:07	906	937
	16.0	54.3	6.8	41.1	138/120	149/129	6:43	948	997
2400	18.3	63.0	7.9	47.6	154/134	160/139	5:39	865	888
	18.0	61.6	7.8	46.6	152/132	158/137	5:48	878	903
	17.0	57.2	7.2	43.2	145/126	153/133	6:20	922	958
	16.0	52.7	6.6	39.9	134/116	147/128	6:57	960	1019
2350	18.3	61.0	7.7	46.1	151/131	158/137	5:52	885	911
	18.0	59.7	7.5	45.1	149/129	156/136	6:01	898	927
	17.0	55.4	7.0	41.9	141/123	151/131	6:34	939	982
	16.0	51.0	6.4	38.6	128/111	145/126	7:13	970	1043
1950	19.8	59.0	7.4	44.6	148/129	155/135	6:06	905	935

SECTION VII. SERVICING

GROUND HANDLING

SERVICING

MAINTENANCE



GROUND HANDLING

Scheduling of preventive maintenance is largely your responsibility as the aircraft operator. A general knowledge of the working order of the aircraft is necessary to perform day-to-day service procedures and to determine when unusual service or shop maintenance is needed.

Service information in this section of the manual is limited to service procedures which you, the operator, will normally perform or supervise yourself. Accomplishment of these service procedures will not adequately substitute for 50-hour, 100-hour, and annual inspections and specialized maintenance at Mooney Service Centers.

It is wise to follow a planned schedule of periodic lubrication and preventive maintenance based on climatic and operating conditions where your aircraft is in service. Federal Aviation Administration regulations require that all airplanes have annual inspections performed by a designated FAA representative. A 100-hour periodic inspection by an "appropriately-rated mechanic" is required if the aircraft is flown for hire. FAA Regulations also state that "the owner or operator of an aircraft is primarily responsible for maintaining that aircraft in an airworthy condition . . . . In addition, he shall ensure that maintenance personnel make appropriate entries in the aircraft and engine records indicating the aircraft has been released for service." This responsibility also includes keeping "a chronological listing of compliance with mandatory service bulletins, Airworthiness Directives, and the method of compliance." It is further the responsibility of the aircraft owner or operator to obtain service information pertaining to his aircraft. The manufacturer makes this information available to the owners through its distributors and dealers, and also from the factory. An index of current service information pertaining to aircraft, by serial number, may be obtained by subscription (without cost) from Mooney Aircraft Corporation from its distributors and dealers. It is advisable that Mooney owners keep in contact with authorized Mooney service facilities to ensure compliance with pertinent service information.

Should an extraordinary or difficult problem arise concerning repair or upkeep of your aircraft, consult the Customer Service Department, Mooney Aircraft Corp. Box 72, Kerrville, Texas 78028. Phone Area Code 512 257-4043.

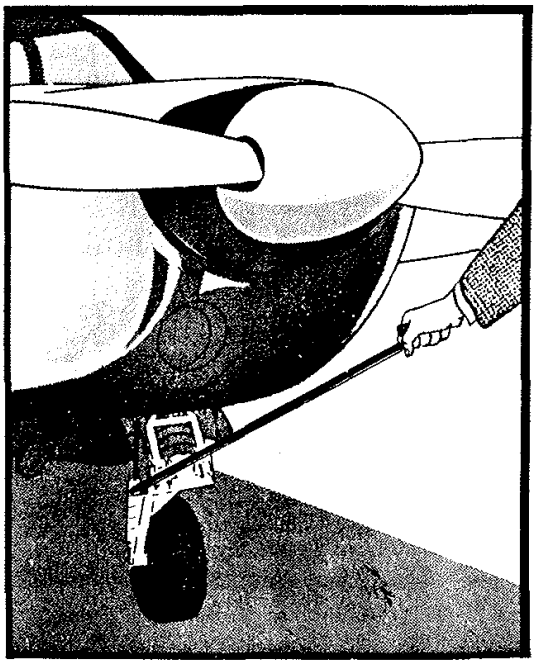


FIGURE 7-1. TOWING

TOWING

For maneuvering the aircraft in close quarters, in the hangar, or on the ramp, use the tow bar furnished with the aircraft loose equipment. Figure 7 - 1 shows the tow bar attached to the nose gear for manual ground maneuvering. When using the tow bar, never exceed the maximum nose gear turning angle indicated on the nose wheel turn indicator. Towing the aircraft with another vehicle is not recommended, as damage to the gear structure could result.

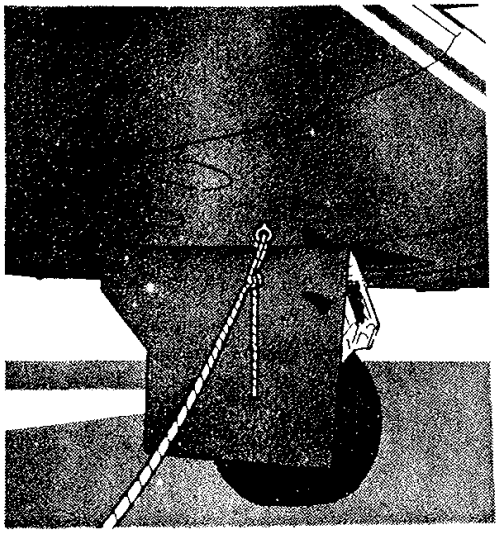


FIGURE 7-2. REMOVABLE TIEDOWN EYEBOLT LOCATION

TIEDOWN

As a precaution against wind damage, always tie down the aircraft when parked outside. Removable wing tiedown eyebolts, supplied with the loose equipment, screw into wing receptacles marked HOIST POINT just outboard of each

main gear as shown in Figure 7-2. Replace these eyebolts with jack point fixtures when it is necessary to lift the aircraft with jacks. The tail tiedown ring is under the tail skid.

To tie down the aircraft:
(1) Park the airplane facing the wind.
(2) Fasten the co-pilot seat belt through the flight control wheel.
(3) Fasten strong ground-anchored chain or rope to the installed wing tiedown eyebolts, and place wheel chocks fore and aft of each wheel.
(4) Fasten a strong ground-anchored chain or rope to the empennage tiedown ring.

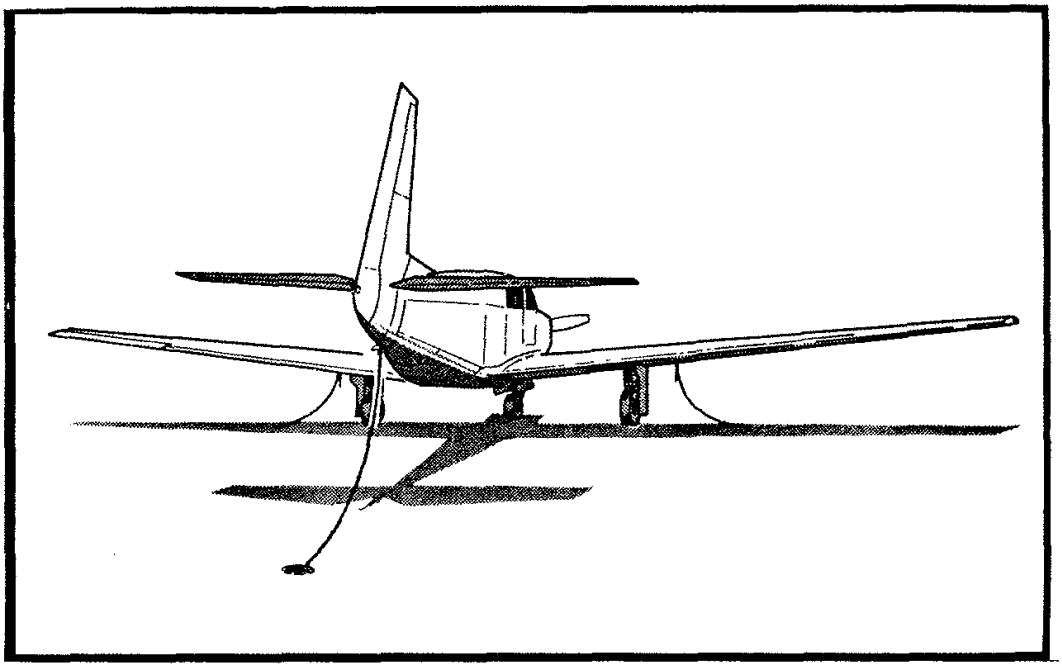


FIGURE 7-3. TIEDOWN

SERVICING

REFUELING

Integral sealed tanks in the front inboard sections of the wings carry the fuel. With the aircraft standing on level

ground, service each fuel tank after flight with 100/130 octane aviation-grade gasoline.

Before filling the fuel tanks when planning a maximum weight flight configuration, consult the Weight & Balance Record in the airplane file for loading data.

CAUTION: Never use aviation fuel of a lower grade than 100/130 octane. Aviation fuel grades can be distinguished by their color: 80/87 octane is red, 91/96 octane is blue, 100/130 octane is green, 115/145 octane is purple.

Sample fuel from the sump drain in each tank before the first flight of the day and after each refueling to check for water or sediment contamination.

WARNING: Allow five minutes after refueling for water and sediment to settle in the tank and fuel selector valve drain before taking fuel samples or draining the selector valve.

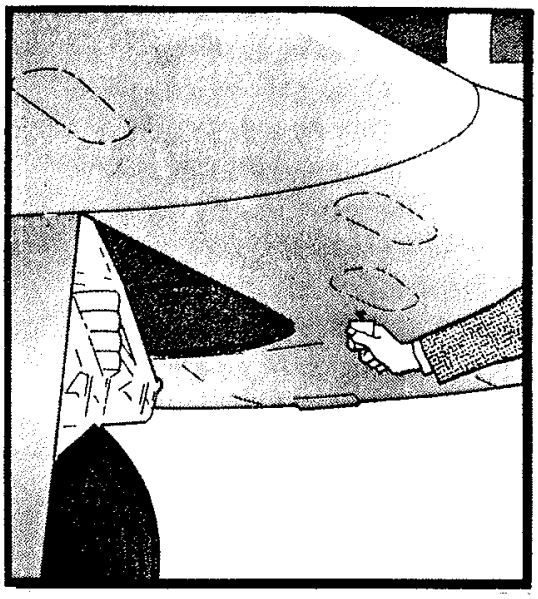


FIGURE 7-4. FUEL SAMPLING

Figure 7-4 shows tank sump drain access. These drains are near each wing root forward of the wheel wells. A small plastic cup is supplied in the loose equipment kit for obtaining fuel samples. To collect a fuel sample, insert the cup actuator prong in the sump drain receptacle and push upward to open the valve momentarily and drain fuel into the cup. If water is in the fuel, a distinct line separating the water from the gasoline will be seen

through the transparent cup wall. Water, being heavier, will settle to the bottom of the cup, while the colored fuel will remain on top. Continue taking fuel samples until all water is purged from the tank.

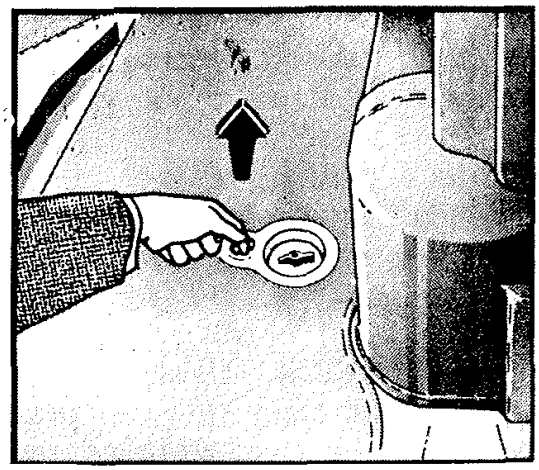


FIGURE 7-5. SELECTOR VALVE CONTROLS

The fuel tank selector valve drain control is on the cabin floor forward of the pilot's seat. To flush the fuel selector valve sump and the lines leading from the wing tanks to the selector valve, turn the selector handle to the left, and pull the fuel drain control for about five seconds. Repeat the procedure for the right tank, being sure that the fuel drain control knob is returned to the closed position and that the drain valve is not leaking.

ENGINE LUBRICATION

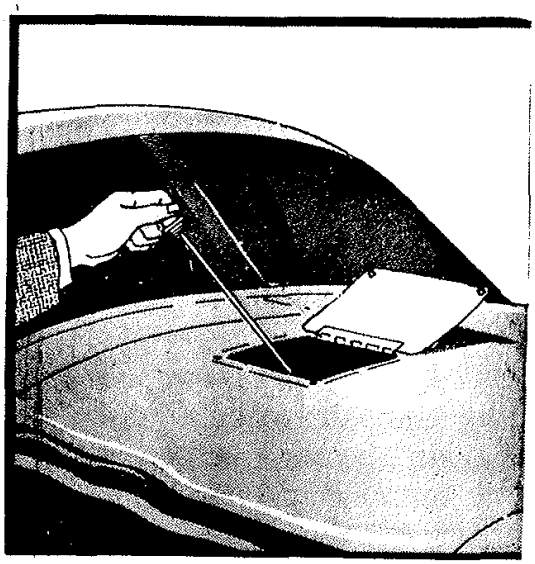


FIGURE 7-6. OIL DIPSTICK ACCESS

The new Lycoming engine has been carefully run-in and rigidly tested at the factory. Operate the new engine at full power within the limitations given in Section V. Before every flight, check the engine oil level and replenish as necessary. (During the first 50 hours of operation, add only straight mineral oil. Do not add a detergent-type oil.) Oil capacity is eight quarts. Figure 7-6 shows the dipstick and its access cover located in the rear area of the engine cowling.

The preservative oil in the new engine should be removed after the first 25 hours of operation. Replace the original preservative oil with only straight mineral oil. Do not change to or add additive-type oil (high detergent or compounded) during the first 50 hours of operation, or until a normal rate of oil consumption has been established.

After oil consumption has stabilized, any straight mineral or additive-type engine oil may be used that conforms to Lycoming specification No. 301E. Following the break-in period it is permissible to change from straight mineral (break-in) oil to an additive (high detergent) oil and observe the normal oil-change intervals.

However, when changing from straight mineral oil to an additive-type oil at a later time (up to 250 hours after break-in), the following precautionary measures should be observed:

(1) Change the oil again after not more than five hours of operation.
(2) Check all oil screens for evidence of sludge or plugging. Change the oil every 10 hours if sludge conditions prevail. Change the oil at normal intervals after sludge conditions improve.
(3) If the engine has been allowed to operate on straight mineral oil for several hundred hours, or if the engine is in an excessively dirty condition, defer the change to additive oil until after engine overhaul and operation for at least 50 hours.

Your Mooney service and marketing center will change the engine oil in addition to performing all other service and inspection procedures needed when you bring your airplane in for its 50-hour, 100-hour, and annual periodic inspections. The engine oil should, however, be replaced at 25-hour intervals after prolonged flight in adverse weather, after continuous operation at high power settings, or when making short flights with long ground-idle time. Excessive oil sludge buildup indicates that the oil system needs servicing at less than 50-hour intervals.

Lycoming Service Instruction No. 1014 (latest revision) lists recommended oil types and replacement intervals. Your Mooney service and marketing centers have approved brands of lubricating oil and all consumable materials necessary to service your airplane.

GEAR & TIRE SERVICE

The aircraft is equipped with standard-brand tires and tubes. Keep the main gear tires inflated at 30 PSI and the nose tire at 30 PSI for maximum service life. Proper inflation will minimize tire wear and impact damage. Visually inspect the tires at preflight for cracks and ruptures, and avoid taxi speeds that require heavy braking or fast turns. Keep the gear and exposed gear retraction system components free of mud and ice to avert retraction interference and binding.

The gear warning horn may be checked in flight by retarding the throttle with the gear up. The gear horn should sound with a regular, intermittent note at about 12 inches manifold pressure.

BATTERY SERVICE

The 12-volt 35-ampere-hour electrical storage battery is located in the left side of the engine compartment. Check battery fluid level every 25 flight hours or each 30 days, whichever comes first. To gain access to the battery, open the battery access door in the top left engine cowling.

To service the battery, remove the battery box cover and check the terminals and connectors for corrosion. Add distilled water to each battery cell as necessary; keep the fluid at one-quarter inch over the separator tops. Check the fluid specific gravity for a reading of 1.265 to 1.275. A recharge is necessary when the specific gravity is 1.240

or lower. Start charging at four amperes and finish at two amperes; do not allow battery temperature to rise above 120°F during recharging. Keep the battery at full charge to prevent freezing in cold weather and to prolong service life.

> CAUTION: The alternator and voltage regulator operate only as a one-polarity system. Be sure the polarity is correct when connecting a charger or booster battery.

If appreciable corrosion is noticed, flush the battery box with a solution of baking soda and water. Do not allow soda solution to enter the battery cells. Keep cable connections clean and tightly fastened, and keep overflow lines free of obstruction.

MAINTENANCE

PROPELLER CARE

The high stress to which propeller blades are subjected makes their careful inspection and maintenance vitally important. Check the blades for nicks, cracks, or indications of other damage before each flight. Nicks tend to cause high-stress concentrations in the blades which, if ignored, may result in cracks. Have any nicks deeper than approximately .010 inch removed before the next flight.

It is not unusual for the propeller to have some end play as a result of manufacturing tolerances in the parts. This end play has no adverse affect on propeller performance, because centrifugal force firmly seats the blades when in operation.

EXTERIOR CARE

As with any paint applied to a metal surface, an initial curing period is necessary for developing the desired qualities of durability and appearance. Therefore, do not apply wax or polish to the new aircraft exterior until two or three months after delivery. Wax substances will seal paint from

Notes