nose gear strut should show no sign of fluid leakage and should be inflated to show 3 inches of strut exposure. Clean and check the windshield. Remove the nose wheel chock if one has been employed.

RIGHT WING

Check the right wing using the same procedure as performed on the left wing.

FUSELAGE (RIGHT SIDE)

Check the general condition of the fuselage. Check that all antenna access panels are in place and securely attached. Be sure that the side and rear windows are clean. Check that the openings in the static pad are clean and unobstructed.

EMPENNAGE

Surfaces of the empennage should be examined for damage and operational interference. Check all visible and accessible hinges and attachments. Remove the tie-down if one has been employed.

FUSELAGE (LEFT SIDE)

Check the left side of the fuselage using the same procedure as performed on the right.

When the stall warning device and the optional pitot heat and navigation lights, if installed, are to be checked for proper functioning, turn ON the master switch and the appropriate electrical switches. Visually confirm that exterior lights are operational. Lift the stall detector on the left wing and observe that the warning horn sounds. Check the pitot heat by carefully feeling the pitot head. Use caution as the head can become extremely hot. When these checks are complete, return the master switch and the electrical switches to their OFF positions.

4.11 BEFORE STARTING ENGINE

After entering the cockpit and before starting the engine, close and latch both cabin doors, securing the main latch first, and then engaging the overhead latch. If a door is to be left open, in warm weather for example, the latching procedure must be completed before takeoff.

Seats should be positioned for best comfort and visibility. Be sure that the seats are securely latched in the tracks. Fasten seat belts and harnesses. Check that all circuit breakers are in. Exercise the throttle and mixture levers through their full travel to ensure that they operate smoothly. Set the parking brake; check that the carburetor heat control is fully OFF; and set the fuel selector lever to the desired tank position.

4.13 STARTING ENGINE

(a) Starting Engine When Cold

Prime using two to four strokes for starts when the temperature is +40° F. Use more primer strokes for colder temperatures. On the last priming stroke, leave the primer in the out position. Throttle should be set 1/2 inch open. Turn ON the master switch and the electric fuel pump. Move the mixture control to full RICH and engage the starter by rotating the magneto switch clockwise. When the engine fires, release the magneto switch, and push the primer in slowly to keep engine running. Advance the throttle slightly and lock primer.

NOTE

This engine does not have an accelerator pump in the carburetor; thus, pumping the throttle will not aid in starting.

If the engine does not fire within ten seconds, disengage the starter, wait thirty seconds, and repeat the starting procedure.

(b) Starting Engine When Hot

Close the throttle. Turn ON the master switch and the electric fuel pump. Move the mixture control lever to full RICH and engage the starter by rotating the magneto switch clockwise. When the engine fires, release the magneto switch and move the throttle to the desired setting. If the engine does not start, open the throttle 1/2 inch and try again.

(c) Starting Engine When Flooded

The throttle lever should be full OPEN. Turn ON the master switch and turn OFF the electric fuel pump. Move the mixture

control lever to idle cut-off and engage the starter by rotating the magneto switch clockwise. When the engine fires, release the magneto switch, advance the mixture and retard the throttle.

(d) Starting Engine With External Power Source*

An optional external power receptacle allows the operator to use an external battery to crank the engine without having to gain access to the airplane's battery.

Turn the master switch OFF and turn all electrical equipment OFF. Connect the RED lead of the external power cable to the POSITIVE (+) terminal of an external 12-volt battery and the BLACK lead to the NEGATIVE (-) terminal. Insert the plug of the jumper cable into the socket located on the fuselage. Note that when the plug is inserted, the electrical system is ON. Proceed with the normal starting technique.

After the engine has started, reduce power to the lowest possible RPM, to reduce sparking, and disconnect the jumper cable from the aircraft. Turn the master switch ON and check the alternator ammeter for an indication of output. DO NOT ATTEMPT FLIGHT IF THERE IS NO INDICATION OF ALTERNATOR OUTPUT.

NOTE

For all normal operations using the external power cables, the master switch should be OFF, but it is possible to use the ship's battery in parallel by turning the master switch ON. This will give longer cranking capabilities, but will not increase the amperage.

CAUTION

A dead or depleted aircraft battery should not be charged in the aircraft.

*Optional

When the engine is firing evenly, advance the throttle to 800 RPM. If oil pressure is not indicated within thirty seconds, stop the engine and determine the trouble. In cold weather it will take a few seconds longer to get an oil pressure indication. To check the operation of the engine driven fuel pump, turn OFF the electric fuel pump and check the fuel pressure. If the engine has failed to start, refer to the Lycoming Operating Handbook, Engine Troubles and Their Remedies.

Starter manufacturers recommend that cranking periods be limited to thirty seconds with a two minute rest between cranking periods. Longer cranking periods will shorten the life of the starter.

4.15 WARM-UP

Warm-up the engine at 800 to 1200 RPM for not more than two minutes in warm weather and four minutes in cold. Avoid prolonged idling at low RPM, as this practice may result in fouled spark plugs.

Takeoff may be made as soon as the ground check is completed and the engine is warm.

Do not operate the engine at high RPM when running up or taxiing over ground containing loose stones, gravel or any loose material that may cause damage to the propeller blades.

4.17 TAXIING

Before ground personnel attempt to taxi the airplane, they should be instructed and approved by a qualified person authorized by the owner. Ascertain that the propeller back blast and taxi areas are clear.

Power should be applied slowly to start the taxi roll. Taxi a few feet forward and apply the brakes to determine their effectiveness. While taxiing, make slight turns to ascertain the effectiveness of the steering.

Observe wing clearances when taxiing near buildings or other stationary objects. If possible, station an observer outside the airplane.

Avoid holes and ruts when taxiing over uneven ground.

Do not operate the engine at high RPM when running up or taxiing over ground containing loose stones, gravel or any loose material that may cause damage to the propeller blades.

4.19 GROUND CHECK

Set the parking brake. The magnetos should be checked at 1800 RPM. Drop off on either magneto should not exceed 175 RPM and the difference between the magnetos should not exceed 50 RPM. Do not operate on a single magneto for too long a period, 2 to 3 seconds is usually sufficient to check drop off and will minimize plug fouling.

NOTE

Avoid engagement of starter or turning the switch to off when performing magneto check.

Check the vacuum gauge; the indicator should read 5.0" ± .1" Hg at 2000 RPM.

Carburetor heat should also be checked prior to takeoff to be sure the control is operating properly and to clear any ice which may have formed during taxiing. Avoid prolonged ground operation with carburetor heat ON as the air is unfiltered.

Prior to takeoff the electric pump should be turned ON again to prevent loss of power during takeoff should the engine driven pump fail. Check both oil temperature and oil pressure. The temperature may be low for some time if the engine is being run for the first time of the day.

To check magneto grounding, retard the throttle to IDLE between 550 and 650 RPM and turn the magneto switch OFF, and immediately back to BOTH. If the magnetos are properly grounded, the engine will stop firing when the switch is in the OFF position.

4.21 BEFORE TAKEOFF

All aspects of each particular takeoff should be considered prior to executing the takeoff procedure.

Check that the master switch is ON, and check and set all of the flight instruments as required. Check the fuel selector to make sure it is on the proper tank (fullest). Set the mixture: turn ON the electric fuel pump and check the engine gauges. The carburetor heat should be in the OFF position.

NOTE

The mixture should be set to FULL RICH but a minimum amount of leaning is permitted for smooth engine operation when taking off at high elevation.

After adjusting the seat for pilot comfort, check to be sure that the seat is securely latched by the two locking pins in the floor track by pushing back and forth.

Both seat backs should be erect, and the seat belts and shoulder harness should be fastened. Fasten the seat belts snugly around an empty seat.

Exercise and set the flaps and trim tab. Insure proper flight control movement and response. Both doors should be properly secured and latched.

4.23 TAKEOFF

NORMAL

For takeoff, the elevator tab should be set slightly aft of neutral, with the exact setting determined by the loading of the airplane. Allow the airplane to accelerate to 53 KIAS, and ease back on the control wheel just enough to rotate to climb attitude. Premature or excessive raising of the nose will result in a delayed takeoff. After takeoff, let the airplane accelerate to the desired climb speed by lowering the nose slightly. Trying to pull the airplane off the ground at too low an airspeed decreases controllability in the event of an engine failure.

Normally, flaps are left up for takeoffs; however for short field takeoffs and for takeoffs under such conditions as deep grass or a soft surface, total distances can be reduced appreciably by lowering the flaps one notch and rotating at a lower airspeed.

SHORT FIELD, OBSTACLE CLEARANCE

Lower the flaps one notch and apply full power before brake release. Accelerate to 53 KIAS, and ease back on the control wheel just enough to rotate. Maintain the best angle of climb speed, 61 KIAS, until the obstacle has been cleared. After obstacle clearance, accelerate to the best rate of climb speed, 70 KIAS, and slowly retract the flaps and continue to climb.

SHORT FIELD, NO OBSTACLE

Lower the flaps one notch and apply full power before brake release. Accelerate to 53 KIAS, and ease back on the control wheel just enough to rotate. After breaking ground, accelerate to the best rate of climb speed, 70 KIAS, and slowly retract the flaps while climbing out.

SOFT FIELD, OBSTACLE CLEARANCE

Lower the flaps one notch. Apply power with brakes released. Ease back on the control wheel just enough to raise the nose wheel from the ground as soon as possible, and lift off at the lowest possible airspeed. Accelerate just above the ground to the best angle of climb speed, 61 KIAS, to climb past the obstacle. After obstacle clearance, accelerate to the best rate of climb speed, 70 KIAS, and slowly retract the flaps and continue to climb.

SOFT FIELD, NO OBSTACLE

Lower the flaps one notch. Apply power with brakes released. Ease back on the control wheel just enough to raise the nose wheel from the ground as soon as possible, and lift off at the lowest possible airspeed. Accelerate just above the ground to the best rate of climb speed, 70 KIAS. Slowly retract the flaps while climbing out.

4.25 CLIMB

The best rate of climb at gross weight will be obtained at 70 KIAS. The best angle of climb may be obtained at 61 KIAS. At lighter than gross weight these speeds are reduced somewhat.

When reaching the desired altitude, the electric fuel pump should be turned off, and the fuel pressure checked.

4.27 CRUISING

The cruising speed is determined by many factors, including power setting, altitude, temperature, loading and equipment installed in the airplane.

The normal maximum cruising power is 75% of the rated horsepower of the engine. Airspeeds, which may be obtained at various altitudes, and power settings can be determined from the performance graphs provided by Section 5.

Use of the mixture control in cruising flight reduces fuel consumption significantly, expecially at higher altitudes, and also reduces lead deposits when the alternate fuels are used. During letdown and low power flight operations, it may be necessary to lean because of excessively rich mixture.

The mixture should be leaned during cruising operation when 75% power or less is being used. If any doubt exists as to the amount of power being used, the mixture should be in the FULL RICH position for all operations. Always enrich the mixture before increasing power settings.

To lean the mixture, pull the mixture control until the engine becomes rough, indicating that the lean mixture limit has been reached in the leaner cylinders. Then enrich the mixture by pushing the control toward the instrument panel until engine operation becomes smooth. When leaning, carefully observe the temperature instruments.

Always remember that the electric fuel pump should be turned ON before switching tanks, and should be left on for a short period thereafter. In order to keep the airplane in best lateral trim during cruising flight, the fuel should be used alternately from each tank. It is recommended that one tank be used for one hour after takeoff, then the other tank be used for two hours; then return to the first tank. Do not run tanks completely dry in flight. The electric fuel pump should be normally OFF so that any malfunction of the engine-driven fuel pump is immediately apparent. If signs of fuel starvation should occur at any time during flight, fuel exhaustion should be suspected, at which time the fuel selector should be immediately positioned to the other tank and the electric fuel pump switched to the ON position.

4.29 APPROACH AND LANDING

Check to insure that the fuel selector is on the proper (fullest) tank and that the seat backs are erect. The seat belts and shoulder harness should be fastened and the inertia reel checked.

Turn the electric fuel pump ON. The mixture should be set in the full RICH position.

The airplane should be trimmed to an initial-approach speed of about 70 KIAS with a final-approach speed of 62 KIAS* or 67 KIAS** with flaps extended fully. The flaps can be lowered at speeds up to 89 KIAS, if desired.

The mixture control should be kept in full RICH position to insure maximum acceleration if it should be necessary to open the throttle again. Carburetor heat should not be applied unless there is an indication of

*Outboard Flow Strips Installed
**Outboard and Inboard Flow Strips Installed

carburetor icing, since the use of carburetor heat causes a reduction in power which may be critical in case of a go-around. Full throttle operation with carburetor heat on can cause detonation.

The amount of flap used during landings and the speed of the aircraft at contact with the runway should be varied according to the landing surface and conditions of wind and airplane loading. It is generally good practice to contact the ground at the minimum possible safe speed consistent with existing conditions.

Normally, the best technique for short and slow landings is to use full flap and enough power to maintain a safe airspeed and approach flight path. Mixture should be full RICH, fuel on the fullest tank, and electric fuel pump ON. Reduce the speed during the flareout and contact the ground close to the stalling speed. After ground contact hold the nose wheel off as long as possible. As the airplane slows down, gently lower the nose and apply the brakes. For short field landings braking is most effective when flaps are raised and back pressure is applied to the control wheel, putting most of the aircraft weight on the main wheels. In high wind conditions, particularly in strong crosswinds, it may be desirable to approach the ground at higher than normal speeds with partial or no flaps.

4.31 STOPPING ENGINE

At the pilot's discretion, the flaps should be raised and the electric fuel pump turned OFF. The radios should be turned OFF, and the engine stopped by pulling the mixture control back to the idle cut-off. The throttle should be left full aft to avoid engine vibration while stopping. After the engine has stopped the magneto and master switches must be turned OFF.

NOTE

When alternate fuels are used, the engine should be run up to 1200 RPM for one minute prior to shutdown to clean out any unburned fuel.

4.33 PARKING

If necessary, the airplane should be moved on the ground with the aid of a nose wheel tow bar. The aileron and stabilator controls should be secured by looping the safety belt through the control wheel and pulling it snug.

Tie downs can be secured to rings provided under each wing and to the tail skid. The rudder is held in position by its connections to the nose wheel steering and normally does not have to be secured.

4.35 STALLS

An approaching stall is indicated by a stall warning horn which is activated between five and ten knots above stall speed. Mild airframe buffeting and gentle pitching may also precede the stall.

The stalling speed at 1670 lbs. gross weight with power off, outboard flow strips installed, and full flaps is 47 KIAS, with flaps up this speed is increased 1 knot; with both outboard and inboard flow strips installed and full flaps the stall speed is 49 KIAS, with flaps up this speed is increased 3 knots. Loss of altitude during stalls can be as great as 320 feet, depending on configuration and power.

NOTE

The stall warning system is inoperative with the master switch OFF.

During preflight, the stall warning system should be checked by turning the master switch ON, lifting the detector and checking to determine if the horn is actuated. The master switch should be returned to the OFF position after the check is complete.

4.37 TURBULENT AIR OPERATION

In keeping with good operating practice used in all aircraft, it is recommended that when turbulent air is encountered or expected, the airspeed be reduced to maneuvering speed to reduce the structural loads caused by gusts and to allow for inadvertent speed build-ups which may occur as a result of the turbulence or of distractions caused by the conditions (See Subsection 2.3). Flight into thunderstorms or severe turbulence should be avoided.

4.39 WEIGHT AND BALANCE

It is the responsibility of the pilot and aircraft owner to determine that the airplane remains within the allowable weight vs. center of gravity envelope while in flight.

For weight and balance data, refer to Section 6 (Weight and Balance).

4.41 MANEUVERS

The airplane is approved for certain aerobatic maneuvers, provided it is loaded within the approved weight and center of gravity limits (See Section 2 - Limitations). The approved maneuvers are spins, steep turns, lazy eights, and chandelles.

Intentional spins are prohibited in the normal category airplane. Lazy eights and chandelles may be performed in the normal category provided a 60 degree angle of bank and/or a 30 degree angle of pitch is not exceeded. For approved maneuvers and entry speed, refer to Section 2 - Limitations.

4.43 SPINS

The airplane is approved for intentional spinning when the flaps are fully retracted.

BEFORE SPINNING

Carrying baggage during the spin is prohibited and the pilot should make sure that all loose items in the cockpit are removed or securely stowed including the second pilot's seat belts if the aircraft is flown solo. Seat belts and shoulder harnesses should be fastened securely and the seat belts adjusted first to hold the occupants firmly into the seats before the shoulder harness is tightened. With the seat belts and shoulder harnesses tight, check that the position of the pilots' seats allow full rudder travels to be obtained and both full back and full forward control wheel movements. Finally check that the seats are securely locked in position. Spins should only be started at altitudes high enough to recover fully by at least 4,000 feet AGL, so as to provide an adequate margin of safety. A one-turn spin, properly executed, will require 1,000 to 1,500 feet to complete and a six-turn spin will require 2,500 to 3,000 feet to complete. The airplane should be trimmed in a power-off glide at approximately 75 knots before entering the stall prior to spinning. This trim airspeed assists in achieving a good balance between airspeed and "g" loads in the recovery dive.

SPIN ENTRY

The spin should be entered from a power-off glide by reducing speed at about 1 kt/sec until the airplane stalls. Apply full aft control wheel and full rudder in the desired spin direction. This control configuration with the throttle closed should be held throughout the spin. The ailerons must remain neutral throughout the spin and recovery, since aileron application may alter the spin characteristics to the degree that the spin is broken prematurely or that recovery is delayed.

SPIN RECOVERY

(a) Apply and maintain full rudder opposite the direction of rotation.
(b) As the rudder hits the stop, rapidly move the control wheel full forward and be ready to relax the forward pressure as the stall is broken.
(c) As rotation stops, centralize the rudder and smoothly recover from the dive.

Normal recoveries may take up to 1-1/2 turns when proper technique is used; improper technique can increase the turns to recover and the resulting altitude loss.

FURTHER ADVICE ON SPINNING

SPIN ENTRY

Application of full aft control wheel and full rudder before the airplane stalls is not recommended as it results in large changes in pitch attitude during entry and the first turn of the spin. Consequently the initial 2-3 turns of the spin can be more oscillatory than when the spin is entered at the stall.

SPIN RECOVERY

The recommended procedure has been designed to minimize turns and height loss during recovery. If a modified recovery is employed (during which a pause of about 1 second - equivalent to about one half turn of the spin - is introduced between the rudder reaching the stop and moving the control column forward) spin recovery will be achieved with equal certainty. However the time taken for recovery will be delayed by the length of the pause, with corresponding increase in the height lost.

In all spin recoveries the control column should be moved forward briskly, continuing to the forward stop if necessary. This is vitally important because the steep spin attitude may inhibit pilots from moving the control column forward positively.

The immediate effect of applying normal recovery controls may be an appreciable steepening of the nose down attitude and an increase in rate of spin rotation. This characteristic indicates that the aircraft is recovering from the spin and it is essential to maintain full anti-spin rudder and to continue to move the control wheel forward and maintain it fully forward until the spin stops. The airplane will recover from any point in a spin in not more than one and one half additional turns after normal application of controls.

MISHANDLED RECOVERY

The airplane will recover from mishandled spin entries or recoveries provided the recommended spin recovery procedure is followed. Improper application of recovery controls can increase the number of turns to recover and the resulting altitude loss.

Delay of more than about 1-1/2 turns before moving the control wheel forward may result in the aircraft suddenly entering a very fast, steep spin mode which could disorient a pilot. Recovery will be achieved by briskly moving the control wheel fully forward and holding it there while maintaining full recovery rudder.

If such a spin mode is encountered, the increased rate of rotation may result in the recovery taking more turns than usual after the control column has been moved fully forward.

In certain cases the steep, fast spin mode can develope into a spiral dive in which the rapid rotation continues, but indicated airspeed increases slowly. It is important to recognize this condition. The aircraft is no longer auto-rotating in a spin and the pilot must be ready to centralize the rudder so as to ensure that airspeed does not exceed 103 kt (V_A) with full rudder applied.

DIVE OUT

In most cases spin recovery will occur before the control wheel reaches the fully forward position. The aircraft pitches nose down quickly when the elevator takes effect and, depending on the control column position, it may be necessary to move the column partially back almost immediately to avoid an unnecessarily steep nose down attitude, possible negative "g" forces and excessive loss of altitude.

Because the aircraft recovers from a spin in a very steep nose-down attitude, speed builds up quickly in the dive out. The rudder should be centralized as soon as the spin stops. Delay in centralizing the rudder may

result in yaw and "fish-tailing." If the rudder is not centralized it would be possible to exceed the maximum maneuver speed (V_A) of 103 kt with the surface fully deflected.

ENGINE

Normally the engine will continue to run during a spin, sometimes very slowly. If the engine stops, take normal spin recovery action, during which the propeller will probably windmill and restart the engine. If it does not, set-up a glide at 75 kt and restart using the starter motor.