

CENTER OF GRAVITY LIMITS

Center of Gravity Range:

Forward: 33.0 inches aft of datum at 2250 lbs. or less, with straight line variation to 39.5 inches aft of datum at 2950 lbs.

Aft: 48.5 inches aft of datum at all weights.

Reference Datum: Front face of firewall.

MANEUVER LIMITS

This airplane is certificated in the normal category. The normal category is applicable to aircraft intended for non-aerobatic operations. These include any maneuvers incidental to normal flying, stalls (except whip stalls), lazy eights, chandelles, and steep turns in which the angle of bank is not more than 60°.

Aerobatic maneuvers, including spins, are not approved.

FLIGHT LOAD FACTOR LIMITS

Flight Load Factors

*Flaps Up: +3.8g, -1.52g

*Flaps Down: +2.0g

*The design load factors are 150% of the above, and in all cases, the structure meets or exceeds design loads.

KINDS OF OPERATION LIMITS

The airplane is equipped for day VFR and may be equipped for night VFR and/or IFR operations. FAR Part 91 establishes the minimum required instrumentation and equipment for these operations. The reference to types of flight operations on the operating limitations placard reflects equipment installed at the time of Airworthiness Certificate issuance.

Flight into known icing conditions is prohibited.

ENGINE FAILURE IMMEDIATELY AFTER TAKEOFF

- (1) Airspeed -- 70 KIAS (flaps UP).
65 KIAS (flaps DOWN).
- (2) Mixture -- IDLE CUT-OFF.
- (3) Fuel Selector Valve -- OFF.
- (4) Ignition Switch -- OFF.
- (5) Wing Flaps -- AS REQUIRED (40° recommended).
- (6) Master Switch -- OFF.

ENGINE FAILURE DURING FLIGHT

- (1) Airspeed -- 70 KIAS.
- (2) Carburetor Heat -- ON.
- (3) Fuel Selector Valve -- BOTH.
- (4) Mixture -- RICH.
- (5) Ignition Switch -- BOTH (or START if propeller is stopped).
- (6) Primer -- IN and LOCKED.

FORCED LANDINGS

EMERGENCY LANDING WITHOUT ENGINE POWER

- (1) Airspeed -- 70 KIAS (flaps UP).
65 KIAS (flaps DOWN).
- (2) Mixture -- IDLE CUT-OFF.
- (3) Fuel Selector Valve -- OFF.
- (4) Ignition Switch -- OFF.
- (5) Wing Flaps -- AS REQUIRED (40° recommended).
- (6) Master Switch -- OFF.
- (7) Doors -- UNLATCH PRIOR TO TOUCHDOWN.
- (8) Touchdown -- SLIGHTLY TAIL LOW.
- (9) Brakes -- APPLY HEAVILY.

PRECAUTIONARY LANDING WITH ENGINE POWER

- (1) Wing Flaps -- 20°.
- (2) Airspeed -- 65 KIAS.
- (3) Selected Field -- FLY OVER, noting terrain and obstructions,
then retract flaps upon reaching a safe altitude and airspeed.
- ~~(4)~~ Radio and Electrical Switches -- OFF.
- ~~(5)~~ Wing Flaps -- 40° (on final approach).
- (6) Airspeed -- 65 KIAS.
- (7) Master Switch -- OFF.

WARNING

After discharging an extinguisher within a closed cabin, ventilate the cabin.

- (4) Land the airplane as soon as possible to inspect for damage.

WING FIRE

- (1) Navigation Light Switch -- OFF.
- (2) Strobe Light Switch (if installed).-- OFF.
- (3) Pitot Heat Switch (if installed) -- OFF.

NOTE

Perform a sideslip to keep the flames away from the fuel tank and cabin, and land as soon as possible using flaps only as required for final approach and touchdown.

ICING

INADVERTENT ICING ENCOUNTER

- (1) Turn pitot heat switch ON (if installed).
- (2) Turn back or change altitude to obtain an outside air temperature that is less conducive to icing.
- (3) Pull cabin heat control full out and rotate defroster control clockwise to obtain maximum defroster airflow.
- (4) Increase engine speed to minimize ice build-up on propeller blades.
- (5) Watch for signs of carburetor air filter ice and apply carburetor heat as required. An unexplained loss in manifold pressure could be caused by carburetor ice or air intake filter ice. Lean the mixture if carburetor heat is used continuously.
- (6) Plan a landing at the nearest airport. With an extremely rapid ice build-up, select a suitable "off airport" landing site.
- (7) With an ice accumulation of 1/4 inch or more on the wing leading edges, be prepared for significantly higher stall speed.
- (8) Leave wing flaps retracted. With a severe ice build-up on the horizontal tail, the change in wing wake airflow direction caused by wing flap extension could result in a loss of elevator effectiveness.
- (9) Perform a landing approach using a forward slip, if necessary, for improved visibility.
- (10) Approach at 80 to 90 KIAS, depending upon the amount of ice accumulation.

- (11) Perform a landing in level attitude.

STATIC SOURCE BLOCKAGE
(Erroneous Instrument Reading Suspected)

- (1) Alternate Static Source Valve -- PULL ON.
- (2) Airspeed -- Consult appropriate table in Section 5 or climb and approach 3 knots faster than normal.
- (3) Altitude -- Cruise 50 feet higher and approach 30 feet higher than normal.

LANDING WITH A FLAT TIRE

- (1) Approach -- NORMAL.
- (2) Wing Flaps -- FULL DOWN.
- (3) Touchdown -- GOOD TIRE FIRST, hold airplane off flat tire as long as possible.

ELECTRICAL POWER SUPPLY SYSTEM
MALFUNCTIONS

OVER-VOLTAGE LIGHT ILLUMINATES

- (1) Master Switch -- OFF (both sides).
- (2) Master Switch -- ON.
- (3) Over-Voltage Light -- OFF.

If over-voltage light illuminates again:

- (4) Flight -- TERMINATE as soon as practical.

AMMETER SHOWS DISCHARGE

- (1) Alternator -- OFF.
- (2) Nonessential Electrical Equipment -- OFF.
- (3) Flight -- TERMINATE as soon as practical.

STARTING ENGINE

- (1) Mixture -- RICH.
- (2) Propeller -- HIGH RPM.
- (3) Carburetor Heat -- COLD.
- (4) Throttle -- OPEN 1/2 INCH.
- (5) Prime -- AS REQUIRED.
- (6) Master Switch -- ON.
- (7) Propeller Area -- CLEAR.
- (8) Ignition Switch -- START (release when engine starts).

NOTE

If engine has been overprimed, start with throttle 1/4 to 1/2 open. Reduce throttle to idle when engine fires.

- (9) Oil Pressure -- CHECK.

NOTE

After starting, check for oil pressure indication within 30 seconds in normal temperatures and 60 seconds in cold temperatures. If no indication appears, shut off engine and investigate.

BEFORE TAKEOFF

- (1) Cabin Doors and Windows -- CLOSED and LOCKED.
- (2) Flight Controls -- FREE and CORRECT.
- (3) Elevator and Rudder Trim -- TAKEOFF.
- (4) Flight Instruments -- SET.
- (5) Radios -- SET.
- (6) Autopilot (if installed) -- OFF.
- (7) Fuel Selector Valve -- BOTH.
- (8) Parking Brake -- SET.
- (9) Throttle -- 1700 RPM.
 - a. Magnetos -- CHECK (RPM drop should not exceed 150 RPM on either magneto or 50 RPM differential between magnetos).
 - b. Propeller -- CYCLE from high to low RPM; return to high RPM (full in).
 - c. Carburetor Heat -- CHECK for RPM drop.
 - d. Engine Instruments and Ammeter -- CHECK.
 - e. Suction Gage -- CHECK.
- (10) Flashing Beacon, Navigation Lights and/or Strobe Lights -- ON as required.

IGNITION-STARTER SYSTEM

Engine ignition is provided by two engine-driven magnetos, and two spark plugs in each cylinder. The right magneto fires the lower left and upper right spark plugs, and the left magneto fires the lower right and upper left spark plugs. Normal operation is conducted with both magnetos due to the more complete burning of the fuel-air mixture with dual ignition.

Ignition and starter operation is controlled by a rotary type switch located on the left switch and control panel. The switch is labeled clockwise, OFF, R, L, BOTH, and START. The engine should be operated on both magnetos (BOTH position) except for magneto checks. The R and L positions are for checking purposes and emergency use only. When the switch is rotated to the spring-loaded START position (with the master switch in the ON position), the starter contactor is energized and the starter will crank the engine. When the switch is released, it will automatically return to the BOTH position.

AIR INDUCTION SYSTEM

The engine air induction system receives ram air through an intake in the lower front portion of the engine cowling. The intake is covered by an air filter which removes dust and other foreign matter from the induction air. Airflow passing through the filter enters an airbox at the front of the engine. After passing through the airbox, induction air enters the inlet in the carburetor which is under the engine, and is then ducted to the engine cylinders through intake manifold tubes. In the event carburetor ice is encountered or the intake filter becomes blocked, alternate heated air can be obtained from a shroud around an exhaust riser through a duct to a valve, in the airbox, operated by the carburetor heat control on the instrument panel. Heated air from the exhaust riser shroud is obtained from unfiltered air inside the cowling. Use of full carburetor heat at full throttle will result in a loss of approximately one to two inches of manifold pressure.

EXHAUST SYSTEM

Exhaust gas from each cylinder passes through riser assemblies to a muffler and tailpipe. The muffler is constructed with a shroud around the outside which forms a heating chamber for cabin heater air.

CARBURETOR AND PRIMING SYSTEM

The engine is equipped with an up-draft, float-type, fixed jet carburetor mounted on the bottom of the engine. The carburetor is equipped with an enclosed accelerator pump, simplified fuel passages to prevent