TAKEOFF AND CLIMB

V_r	55 KIAS (2,400 lb/flaps 0°)	50 KIAS (2,000 lb/flaps 10°)
V_x	56 KIAS (2,400 lb/flaps 10°) (+1 KIAS/2,000')	51 KIAS (2,000 lb/flaps 10°)
V_y	76 KIAS (2,400 lb) (-1 KIAS/2,000')	69 KIAS (2,000 lb)
Cruise climb	85 KIAS (2,400 lb)	78 KIAS (2,000 lb)

CRUISE (approximately 100 KIAS at all altitudes)

2,000' 65% BHP	2350 rpm	106 KTAS	7.3 gal/hr
4,000' 65% BHP	2400 rpm	108 KTAS	7.3 gal/hr
6,000' 66% BHP	2450 rpm	110 KTAS	7.4 gal/hr
8,000' 66% BHP	2500 rpm	112 KTAS	7.4 gal/hr

MANEUVERING

V_a	99 KIAS (2,400 lb)	92 KIAS (2,000 lb)
Best glide	65 KIAS (2,400 lb)	60 KIAS (2,000 lb)

PATTERN AND LANDING

Downwind	2000-2100 rpm	90 KIAS	clean
Glide	1100-1200 rpm	80 KIAS	10° flaps
Base Turn	1100-1200 rpm	80 KIAS	20° flaps
Base	1100-1200 rpm	65 KIAS	30° flaps
Final	1100-1200 rpm	60 KIAS (2,400 lb)	30° flaps
Final	1100-1200 rpm	55 KIAS (2,000 lb)	30° flaps

1. Control wheel lock - Removed/stowed
2. Avionics power switch - Off
3. Circuit breakers - In
4. Master switch right ("Bat") half - On
5. Avionics cooling fan - Audibly operating
6. Fuel quantity indicators; all exterior lights; interior lights (for night flights); and pitot heat (for IFR) - Check
7. Flaps - Extend 20° for exterior inspection
8. Master switch (both halves) - Off
9. Ignition switch - Off
10. Required papers (ARROW) - Aboard/stowed

EXTERIOR INSPECTION

1. Cowling fasteners right side - Secure
2. Nose gear shock strut; scissors, steering arms, and shimmy dampener linkages; tire condition/inflation (34 psi)
3. Exhaust pipe - Secure
4. Prop blades - No nicks; Spinner - Screws secure
5. Cylinder cooling fins and starter ring gear teeth - Condition
6. Alternator belt - Tight
7. Air filter - Condition; Landing/taxi lights - Lenses/filaments
8. Cowling fasteners left side and top - Secure
9. Static port - Unobstructed
10. Left wing strut/leading edge - Condition; Air vent, pitot tube, fuel vent - Unobstructed; test stall horn with squeeze bulb
    a. Left wingtip and wingtip lights
    b. Left aileron, counterweights, hinges, nuts, and rod end
    c. Left flap, flap tracks, rollers, nuts, and rod end
    d. Left wing sump drain - Sample fuel
11. Left main gear strut, brake line, brake disc and pads; Axle nut - Cotter pinned; Tire - Condition and inflation (28 psi)
12. Baggage door - Unlocked, secure
13. Top of left wing, antenna
14. Left side and top of fuselage, ELT antenna
15. Horizontal stabilizer - Condition of top and underside; elevator hinge bolts/nuts; securely attached to right elevator
16. Left side vertical stabilizer, antenna, beacon, tail light
    a. Left side of rudder, rudder hinge bolts and nuts
    b. Right side vertical stabilizer, rudder, antenna
    c. Rudder actuators (bolts, nuts, and cotter pins)

17. Right elevator; trim-tab hardware; horiz. stabilizer
18. Right side and bottom of fuselage, antennas
19. Top of right wing, antenna
20. Right main gear strut, brake line, brake disc and pads; Axle nut - Cotter pinned; Tire - Condition and inflation (28 psi)
21. Right wing sump drain - Sample fuel
    a. Right flap, flap tracks, rollers, nuts, and rod end
    b. Right aileron, hinges, nuts, rod end, counterweights
    c. Right wingtip, lights, leading edge, wing strut, air vent
22. Oil quantity - minimum 5 quarts, dipstick secured
    a. Fuel strainer drain knob - pull for 4 sec. (1st flt. of the day)
    b. Fuel strainer drain valve - closed (not dripping)
    c. Oil dipstick access door closed/latched securely
23. Flaps - Up
24. Fuel tanks - Check fuel quantity sufficient for planned flight plus reserve; Fuel caps - Secure
25. Windscreen - Clean

BEFORE STARTING ENGINE

1. Seats, seat belts, shoulder harnesses - Adjust and lock
2. Pray
3. Brakes - Test hydraulic pressure (pedal resistance)
4. Fuel selector valve - Both
5. Autopilot, electrical equipment, avionics power switch - Off

STARTING ENGINE

1. Mixture - Rich
2. Throttle - Closed
3. Carb heat - Cold
4. Master switch right ("Bat") half - On
5. Primer - 2 to 6 strokes (depending on temp.), then locked
6. Prop area - Clear
7. Brakes - Hold (parking brake - off/released)
8. Throttle - Open 1/8 inch
9. Ignition switch - Start (not longer than 30 seconds); after engine starts, release to Both
10. Oil pressure - Check
11. Master switch left ("Alt") half - On; Ammeter - Check
12. Beacon - On
13. Avionics power switch - On; Radios - Set
14. Transponder - Altitude

ENGINE FIRE IN FLIGHT

1. **Mixture – IDLE CUT-OFF**
2. **Fuel selector valve – OFF**
3. Primer – IN and LOCKED
4. Cabin heat and air – CLOSE (except wing root vents)
5. Pitch – 100 KIAS glide/dive (increase airspeed to blow out fire)
6. Radio – Call MAYDAY on present frequency or 121.5
7. Avionics power switch (when radio is not needed) – OFF
8. Master switch – OFF

If fire is not extinguished

9. Emergency descent – EXECUTE [p. 10]
10. DO NOT RESTART ENGINE
11. Forced landing – EXECUTE [p. 9]

ELECTRICAL FIRE IN FLIGHT

1. **Avionics power switch – OFF**
2. **Master switch (both halves) – OFF**
3. **All other electrical switches – OFF**
4. Vents/cabin air/cabin heat – CLOSED
5. Fire extinguisher – ACTIVATE if needed
6. Cabin – VENTILATE after discharging extinguisher in closed cabin

If fire appears out and electrical power is necessary:

7. Master switch right ("Bat") half – ON
8. Master switch left ("Alt") half – ON
9. Circuit breakers – CHECK for faulty circuit *(do not reset)*
10. Avionics power switch – ON
11. Radios/electrical switches – ON *(one at a time, looking for fire)*
12. Vents/cabin air/cabin heat – OPEN *(when certain fire is out)*

CABIN FIRE

1. **Master switch (both halves) – OFF**
2. **Vents/cabin air/cabin heat – CLOSED (to avoid drafts)**
3. **Fire extinguisher – ACTIVATE**
4. Cabin – VENTILATE after discharging extinguisher in closed cabin
5. Land the airplane as soon as practical to inspect for damage

WING FIRE

1. **Navigation light switch – OFF**
2. **Pitot heat switch – OFF**
3. **Strobe light switch – OFF**
4. **Emergency descent – EXECUTE [p. 10]**

Sideslip to keep flames away from fuel tanks and cabin. Land as soon as possible, using flaps only as required for final approach/touchdown.

PRECAUTIONARY LANDING (with power) **P. 10**

1. Radio – Call PAN-PAN on present frequency or 121.5
2. Passengers – BRIEF
   a. Seat belts/harness – TIGHT
   b. Doors – OPEN and LOCKED (handles forward)
3. CHOOSE LANDING SITE and DRAG IT [p. 8]
4. Avionics power switch (when radio is not needed) – OFF
5. Electrical equipment – OFF

On Final

6. Flaps – 30˚
7. Approach speed – 60 KIAS
8. Touchdown – GENTLY WITH POWER
9. Throttle – IDLE
10. Yoke – FULL AFT
11. Mixture – IDLE CUT-OFF
12. Master Switch – OFF
13. Ignition switch – OFF
14. Brakes – AS REQUIRED

DITCHING (as close as possible to land or boats)

1. Transponder – 7700
2. Radio – Call MAYDAY on present frequency or 121.5
3. Establish glide
   a. With power – set approximately 1400 rpm, Flaps – 30˚, establish 300 ft/min descent at 55 KIAS;
   b. Engine out – 60 KIAS, flaps 10˚
4. Passengers – BRIEF
   a. Heavy objects – SECURE or JETTISON
   b. Seat belts/harness – TIGHT
   c. Doors – OPEN and LOCKED (handles forward)
   d. Face – CUSHION
5. Approach – PARALLEL TO SWELLS or ON BACKSIDE
6. Touchdown – As slowly (near stall) as possible
7. EVACUATE airplane (flood cabin if necessary to open doors)
8. Life vests/raft – INFLATE (after exiting airplane)

EMERGENCY DESCENT

1. Carburetor heat – FULLY ON
2. Throttle – IDLE
3. Bank – STEEP BANK will lower nose & increase descent rate
4. Pitch – LOWER NOSE for airspeeds:
   a. 85 KIAS (V_{FE}) flaps extended 30°
   b. 99 KIAS (V_A) in moderate turbulence (flaps up)
   c. 127 KIAS (V_{NO}) light turbulence; 158 KIAS (V_{NE}) smooth air
5. Throttle – CLEAR ENGINE periodically (except for fire)

BEFORE TAKEOFF **P. 3**

1. Flight controls - Check free and correct
2. Fuel selector valve - Both
3. Elevator and rudder trim - Takeoff
4. Mixture - Full rich
5. Cabin doors and window - Closed and locked
6. Set 1700 rpm; Mags - Check (125 rpm max drop/50 max diff)
   a. Carb heat - Check (for rpm drop), then Cold
   b. Engine instruments/ammeter/suction gauge - Check
7. Flight instruments and radios - Set
8. Transponder - Code set; recheck in Alt mode
9. Review takeoff data and engine failure procedures

RUNWAY LINEUP

1. Align aircraft on centerline; set DG compass to rwy. heading
2. Check windsock, anticipate/set crosswind controls

NORMAL TAKEOFF (Flaps 0° or 10°)

1. Throttle - Smoothly to full open (approximately 2300 rpm)
2. Airspeed indicator - Check for movement
3. Rotate at 55 KIAS (heavy/flaps 0°), 50 KIAS (light/flaps 10°)
4. Flaps - Retract at 60 KIAS (if used for takeoff)

NORMAL (V_y) CLIMB or CRUISE CLIMB

1. Set pitch for 76 KIAS (-1 kt per 2,000' MSL) **or** 85 KIAS
2. Throttle - Full open
3. Mixture (above 3,000' density altitude) - Lean for max rpm

LEVEL OFF/CRUISE

1. Set pitch for level flight at planned cruise airspeed
2. Throttle - Set for cruise (typically 2300-2500 rpm)
3. Trim
4. Mixture - Lean to 50° rich of peak EGT
5. Fuel selector valve (above 5,000' MSL) - Left or Right, then alternate as required during cruise flight

DESCENT (LET-DOWN)

1. Plan a descent point (altitude to lose, distance to go)
2. Throttle - As required (approximately -100 rpm per -100 fpm)
3. Carb heat - On if below 1500 rpm
4. Mixture - Adjust (enrich periodically for smooth operation)

BEFORE LANDING - DOWNWIND

1. Airspeed - 90 KIAS (approximately 2100 rpm)
2. Fuel selector valve - Both
3. Mixture - Full rich
4. Carb heat - Fully on
5. Autopilot - Off

ABEAM TOUCHDOWN POINT

1. Throttle - Set 1100 rpm/idle
2. Flaps - 10º
3. Lower nose to establish 80 KIAS glide
4. Trim

TURNING BASE

Flaps - 20º

BASE

1. Airspeed - 70 KIAS
2. Trim

FINAL

1. Flaps - 30º
2. Airspeed - 55 KIAS (light weight) to 60 KIAS (max weight)
3. Trim

LANDING

1. Throttle - Idle
2. Touchdown on main wheels, lower nose gently
3. Braking - Minimum required

GO-AROUND/REJECTED LANDING

1. Throttle - Smoothly to full open (approximately 2300 rpm)
2. Carb heat - Cold
3. Flaps - Raise to 20º immediately
4. Trim - Nose down trim as necessary to help control pitch-up
5. Set pitch to takeoff attitude to climb and accelerate
6. Flaps - 10º ('til obstacles cleared); Retract at 60 KIAS

STOP-AND-GO AFTER LANDING/BEFORE TAKEOFF

1. Brake normally to a stop
2. Flaps - Retract to 0º or 10º
3. Carb heat - Off
4. Trim - Takeoff

ROUGH-RUNNING ENGINE (no indication of engine damage)

1. Mixture – ADJUST

If still rough, magneto or magneto timing may be a problem…

2. Ignition – SELECT EACH MAGNETO INDIVIDUALLY
3. If roughness disappears, leave ignition on that magneto
4. Land as soon as practical

GRADUAL LOSS OF POWER (usually carburetor ice)

1. **Carburetor heat – FULLY ON**
2. Mixture – ADJUST

SUDDEN LOSS OF POWER (usually fuel starvation)

1. **Fuel selector valve – LEFT or RIGHT for 1 min., then switch to opposite side**
2. **Mixture – RICH**

ENGINE FAILURE DURING FLIGHT

1. **Pitch – SET FOR 65 KIAS and TRIM**
2. **Carburetor Heat – FULLY ON**
3. **Fuel Selector Valve – BOTH, (or if already in BOTH) – select LEFT or RIGHT for 1 min., then switch to opposite side**
4. **Mixture – RICH**
5. Primer – IN and LOCKED
6. Landing field – SELECT and MANEUVER TOWARD IT
7. Ignition switch – BOTH (or START if propeller is stopped)

If power not restored – EXECUTE FORCED LANDING [below]

FORCED LANDING (without power)

1. Transponder – 7700
2. Radio – Call MAYDAY on present frequency or 121.5
3. Passengers – BRIEF
   a. Seat belts/harness – TIGHT
   b. Doors – OPEN and LOCKED (handles forward)
4. Mixture – IDLE CUT-OFF
5. Fuel Selector Valve – OFF
6. Ignition switch – OFF
7. Flaps – AS REQUIRED (maneuvering)
8. Final approach speed – 65 KIAS (flaps up), 60 KIAS (down)
9. Flaps – 30˚
10. Master Switch – OFF
11. Touchdown – as slowly (near stall) as possible
12. Yoke – FULL AFT
13. Brakes – AS REQUIRED

BASIC IN-FLIGHT EMERGENCY PROCEDURES **P. 8**

1. **MAINTAIN AIRCRAFT CONTROL**
2. **ANALYZE THE SITUATION AND TAKE PROPER ACTION**
3. **LAND AS SOON AS PRACTICAL**

ENGINE FIRE DURING START ON THE GROUND

1. **Ignition – START** (continuing cranking pulls flames into engine)

If engine starts:

2. Throttle – 1700 RPM for a few minutes
3. Engine – SHUTDOWN and inspect for damage

If engine fails to start:

4. Throttle – FULL OPEN
5. Mixture – IDLE CUT-OFF
6. Ignition – START (continuing cranking for another 30 seconds)
7. Engine – SECURE
   a. Fuel selector valve – OFF
   b. Ignition switch – OFF
8. Radio – CALL FOR ASSISTANCE
9. Master switch – OFF
10. Aircraft – EVACUATE
11. Fire extinguisher – USE TO EXTINGUISH FIRE
12. Aircraft – INSPECT for fire damage *(repair damage or replace damaged components or wiring before attempting another flight)*

ENGINE FAILURE DURING TAKEOFF RUN

1. **Throttle – IDLE**
2. **Brakes – APPLY**
3. **Wing Flaps – RETRACT (if stopping distance critical)**
4. Mixture – IDLE CUT-OFF
5. Ignition Switch – OFF
6. Radio – Inform tower/CTAF of aborted takeoff
7. Master switch – OFF (if departing runway surface)

ENGINE FAILURE IMMEDIATELY AFTER TAKEOFF

1. **Lower nose – maintain 65 KIAS (flaps UP), 60 KIAS (DOWN)**
2. **Choose landing site STRAIGHT AHEAD**
3. Mixture – IDLE CUT-OFF
4. Fuel Selector Valve – OFF
5. Ignition switch – OFF
6. Doors – OPEN and LOCKED (handles forward)
7. Wing Flaps – AS REQUIRED
8. Radio – Make MAYDAY call if able
9. Master Switch – OFF
10. Approach speed – 60 KIAS (flaps DOWN)

BEFORE TAKEOFF (MULTIPLE PATTERNS) **P. 5**

1. Fuel selector valve - Both
2. Trim - Takeoff
3. Mixture - Full rich
4. Carb heat - Off

SHORT-FIELD TAKEOFF

1. Flaps - 10^{o}
2. Brakes - Hold
3. Throttle - Smoothly to full open (approximately 2300 rpm); at density altitudes above 3,000’ lean for max rpm
4. Brakes - Release
5. Yoke - lift nosewheel at 55 KIAS
6. Set pitch for 56 KIAS **until obstacles cleared**
7. Set pitch for 60 KIAS (Vx at S.L., + 1 kt per 2,000’ MSL)
8. Flaps - Retract
9. Set pitch for normal Vy climb (76 KIAS -1 kt/2,000’ MSL)

SHORT-FIELD LANDING

1. Airspeed - 55 KIAS (light weight) to 60 KIAS (max weight)
2. Flaps - 30^{o}
3. At touchdown - Lower nosewheel to ground, retract flaps
4. Bring yoke to full aft as you apply heavy braking as required

SOFT-FIELD TAKEOFF

1. Flaps - 10^{o} (prior to entering takeoff surface)
2. Yoke - Full aft and hold it there until nosewheel lifts off
3. Taxi onto airstrip and align without stopping
4. Throttle - Smoothly advance to full open as aircraft aligns
5. At nosewheel liftoff - Ease yoke forward, hold takeoff attitude
6. Aircraft will fly off at min airspeed (below 40 KIAS)
7. Yoke - Ease forward to level off in ground effect
8. Accelerate to 60 KIAS, pitch for Vy (76 KIAS), retract flaps

SOFT-FIELD LANDING

1. Airspeed - 55 KIAS (light weight) to 60 KIAS (max weight)
2. Flaps - 30^{o}
3. Make a gentle touchdown with power
4. Yoke - Ease it to full aft
5. Flaps - Leave down
6. Throttle - As necessary to keep aircraft rolling

NO-FLAP LANDING **P. 6**

1. Base airspeed - 70 KIAS (light weight) to 75 mph (max wt.)
2. Final airspeed - 60 KIAS (light weight) to 65 KIAS (max wt.)
3. Braking - as necessary (do not plan to use normal turnoff)

SIMULATED ENGINE-OUT (S.E.O.) LANDING
ABEAM TOUCHDOWN POINT

1. Carb heat - Fully on
2. Throttle - Idle
3. Flaps - 10º
4. Lower nose for 65-KIAS glide and trim

BASE

1. Fly tighter base to insure making runway
2. Airspeed - 65 KIAS
3. Flaps - Use judiciously to control airspeed and glidepath

FINAL

1. Airspeed - 60 KIAS
2. Flaps - As required; do not select 30º until landing assured

AFTER LANDING (clear of runway)

1. Flaps - Retract
2. Carb heat - Cold
3. Pitot heat - Off
4. Landing light - Off
5. Spot tracker (last landing) - √ OK button until green light on
6. Flight plan (if applicable) - Close

ENGINE SHUTDOWN

1. Throttle - Idle
2. Avionics power switch - Off
3. Master switch left ("Alt") half - Off
4. Ignition switch - L, then R, then Off, then back to Both (mag grounding check)
5. Mixture - Idle cut-off
6. Ignition switch - Off (after prop stops turning)
7. Master switch right ("Bat") half - Off
8. Key - Remove from ignition
9. Spot tracker - Off

DRAGGING A FIELD **P. 7**

Assess the field suitability with **Wind LASSO**
Wind (strength and direction)
L - Length
A - Altitude (elevation to figure pattern altitude, density altitude)
S - Slope (upslope/downslope and sideslope)
S - Surface condition (grass [length], dirt, gravel, sand, ruts, etc.)
O - Obstructions (rocks, stumps, etc. on the field; also obstructions on the final approach and departure corridors)

1. Overfly the field along its length at a safe altitude
2. If the field is on a slope, fly from uphill to downhill
3. Airspeed - approximately (but not slower than) 70 KIAS
4. Flaps - 20º
5. Estimate length of field (100 ft/sec times number of seconds):
   c. Fly GPS groundspeed of 60 kts (in calm or headwind)
   d. Time the pass over the field in seconds, multiply by 100
   e. The product is the approximate length of the field in feet
   f. If 60 kts GS is less than 70 KIAS (in tailwind), fly 90 kt GS and use 150 ft/sec times number of seconds
6. Make low pass(es) at approx. 50' AGL to assess field slope, surface condition, and obstructions