

**SECTION 4**

**NORMAL PROCEDURES**

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**SECTION 4**

**NORMAL PROCEDURES**

**RECOMMENDED AIRSPEEDS**

Takeoff and Climb	60 KIAS
Maximum Rate of Climb ( $V_y$ )	53 KIAS
Maximum Range	83 KIAS*
Significant Turbulence	60 to 70 KIAS*
Landing Approach	60 KIAS
Autorotation	60 to 70 KIAS*

\* Certain conditions may require lower airspeed.  
See  $V_{ne}$  placards in Section 2.

**DAILY OR PREFLIGHT CHECKS**

Remove all covers and tiedowns. Remove even small accumulations of frost, ice, or snow, especially from rotor blades. Check maintenance records to verify aircraft is airworthy.

Check general condition of aircraft and verify no visible damage, fluid leakage, or abnormal wear. Verify no fretting at seams where parts are joined together. Fretting of aluminum parts produces a fine black powder while fretting of steel parts produces a reddish-brown or black residue. Verify Telatemps show no temperature increase that cannot be attributed to a change in operating conditions (mechanics draw a reference line to the right of the highest temperature square which has darkened in operation). Verify torque stripes on critical fasteners are not broken or missing.

**DAILY OR PREFLIGHT CHECKS (cont'd)**

1. Cowl Door

- Battery switch . . . . . ON
- Oil pressure and alternator lights . . . . . ON
- Warning light test switches . . . . . Push to test
- Fuel quantity . . . . . Check gages
- Battery switch . . . . . OFF
- Aux fuel tank quantity . . . . . Check
- Fuel filler cap . . . . . Tight
- Aux fuel tank . . . . . No leaks
- Fuel lines . . . . . No leaks
- Fuel tank sump drain(s) . . . . . Sample
- Gearbox oil . . . . . Full, no leaks
- Rotor brake . . . . . Actuation normal
- Flex coupling . . . . . No cracks, nuts tight
- Yoke flanges . . . . . No cracks
- Gearbox Telatemp . . . . . Normal
- Sprag clutch . . . . . No leaks
- Static source . . . . . Clear
- Control rod ends . . . . . Free without looseness
- Steel tube frame . . . . . No cracks
- All fasteners . . . . . Tight
- Tail rotor control . . . . . No interference
- Cowl door . . . . . Latched

2. Engine Right Side

- Carb air ducts . . . . . Secure
- Carb heat scoop . . . . . Secure
- Engine sheet metal . . . . . No cracks
- Electrical terminals . . . . . Tight
- Fuel line . . . . . No leaks
- Oil cooler door . . . . . Check
- Oil lines . . . . . No leaks or chafing
- Exhaust system . . . . . No cracks
- Engine general condition . . . . . Check
- V-belt condition . . . . . Check
- V-belt slack . . . . . Check
- Sprag clutch . . . . . No leaks
- Upper bearing . . . . . No leaks
- Telatemp - upper bearing . . . . . Normal

**DAILY OR PREFLIGHT CHECKS (cont'd)**

- 2. Engine Right Side (cont'd)
  - Lower sheave groove wear . . . . Smooth & uniform
  - Flex coupling . . . . . No cracks, nuts tight
  - Yoke flanges . . . . . No cracks
  - Steel tube frame . . . . . No cracks
  - Tail rotor control . . . . . No interference
  
- 3. Engine Rear
  - Cooling fan nut . . . . . Pin in line with marks
  - Cooling fan . . . . . No cracks
  - Fan scroll . . . . . No cracks
  - Telatemps - lower bearing . . . . . Normal
  - Lower bearing . . . . . No leaks
  
- 4. Empennage
  - Tail surfaces . . . . . No cracks
  - Fasteners . . . . . Tight
  - Position light . . . . . Check
  
- 5. Tail Rotor
  - Gearbox Telatemp . . . . . Normal
  - Gearbox . . . . . Oil visible, no leaks
  - Blades . . . . . Clean and no damage/cracks
  - Pitch links . . . . . No looseness
  - Teeter bearings . . . . . Check condition
  - Teeter bearing bolt . . . . . Does not rotate
  - Control bellcrank . . . . . Free without looseness
  
- 6. Tailcone
  - Rivets . . . . . Tight
  - Skins . . . . . No cracks or dents
  - Strobe light condition . . . . . Check
  - Antenna . . . . . Check
  - Attachment bolts . . . . . Tight

**DAILY OR PREFLIGHT CHECKS (cont'd)**

**7. Engine Left Side**

- Engine oil . . . . . 4-6 qt
- Oil filter (if installed) . . . . . Secure, no leaks
- Fuel lines . . . . . No leaks
- Gascolator drain . . . . . Sample
- Throttle linkage . . . . . Operable
- Battery and relay (if located there) . . . . . Secure
- Alternator belt tension . . . . . Check
- Steel tube frame . . . . . No cracks
- Engine sheet metal . . . . . No cracks
- Exhaust system . . . . . No cracks
- Engine general condition . . . . . Check

**8. Main Fuel Tank**

- Quantity . . . . . Check
- Filler cap . . . . . Tight
- Leakage . . . . . None
- Sump drain (non-bladder tank) . . . . . Sample

**9. Main Rotor**

***CAUTION***

Do not pull rotor blades down as damage may occur. To lower one blade, push opposite blade up.

- Blades . . . . . Clean and no damage/cracks

***CAUTION***

Verify erosion on lower surface of blades has not exposed skin-to-spar bond line. Reference Rotor Systems description in Section 7.

- Pitch change boots . . . . . No leaks
- Main hinge bolts . . . . . Cotter pins installed
- All rod ends . . . . . Free without looseness
- Pitch link jam nuts . . . . . Tight
- Pitch link safety wire . . . . . Secure
- All fasteners . . . . . Tight
- Swashplate scissors . . . . . No excessive looseness

**DAILY OR PREFLIGHT CHECKS (cont'd)**

**10. Fuselage Left Side**

- Baggage compartment . . . . . Check
- Removable controls . . . . . Secure if installed
- Collective control . . . . . Clear
- Seat Belt . . . . . Check condition and fastened
- Door . . . . . Unlocked and latched
- Door hinge safety pins . . . . . Installed
- Landing gear . . . . . Check
- Ground handling wheel . . . . . Removed
- Position light . . . . . Check

**11. Nose Section**

- Pitot tube . . . . . Clear
- Windshield condition and cleanliness . . . . . Check
- Fresh air vent . . . . . Clear
- Landing lights . . . . . Check

**12. Fuselage Right Side**

- Landing gear . . . . . Check
- Ground handling wheel . . . . . Removed
- Position light . . . . . Check
- Door hinge safety pins . . . . . Installed
- Baggage compartment . . . . . Check

**13. Cabin Interior**

- Loose articles . . . . . Removed or stowed
- Seat belt . . . . . Check condition
- Instruments, switches, and controls . . . . . Check condition
- Clock . . . . . Functioning

***CAUTION***

For helicopters with removable controls, remove left seat controls if person in that seat is not a rated helicopter pilot.

***CAUTION***

Be sure rotor blades are approximately level to avoid possible tailcone strike.

**DAILY OR PREFLIGHT CHECKS (cont'd)**

***CAUTION***

When flying solo, fill left baggage compartment to capacity before using right compartment. Avoid placing objects in compartments which could injure occupant if seat collapses during a hard landing.

***CAUTION***

Shorter pilots may require cushion to obtain full travel of all controls. Verify aft cyclic travel is not restricted.

**BEFORE STARTING ENGINE**

- Seat belts . . . . . Fastened
- Fuel shut-off valve . . . . . ON
- Cyclic/collective friction . . . . . OFF
- Cyclic, collective, pedals . . . . . Full travel free
- Throttle . . . . . Full travel free
- Collective . . . . . Full down, friction ON
- Cyclic . . . . . Neutral, friction ON
- Pedals . . . . . Neutral
- Rotor brake . . . . . Disengaged
- Circuit breakers . . . . . In
- Carb heat . . . . . OFF
- Mixture . . . . . Full rich
- Mixture guard\* . . . . . Installed
- Primer (if installed) . . . . . Down and locked
- Landing lights . . . . . OFF
- Avionics switch (if installed) . . . . . OFF
- Clutch . . . . . Disengaged
- Altimeter . . . . . Set
- Governor switch . . . . . ON

\* Mixture guard is not used on aircraft with vernier mixture control on console face.



**STARTING ENGINE AND RUN-UP**

Throttle twists for priming . . . . . As required  
Throttle . . . . . Closed  
Battery, strobe switches . . . . . ON  
Area . . . . . Clear  
Ignition switch . . . . . Start, then Both  
Starter-On light . . . . . Out  
Set engine RPM . . . . . 50 to 60%  
Clutch switch . . . . . Engaged  
Blades turning . . . . . Less than 5 seconds  
Alternator switch . . . . . ON  
Oil pressure within 30 seconds . . . . . 25 psi minimum  
Avionics, headsets . . . . . ON  
Wait for clutch light out . . . . . Circuit breakers in  
Warm-up RPM . . . . . 70 to 75%  
Engine gages . . . . . Green  
Mag drop at 75% RPM . . . . . 7% max in 2 seconds  
Carb heat . . . . . CAT rise/drop, set as required  
Sprag clutch check . . . . . Needles split  
Doors . . . . . Closed and latched  
Limit MAP chart . . . . . Check  
Cyclic/collective friction . . . . . OFF  
Governor On, increase throttle . . . . . RPM 102-104%  
Warning lights . . . . . Out  
Lift collective slightly, reduce RPM . . . . . Horn/light at 97%

***CAUTION***

Avoid continuous operation at rotor speed of 60 to 70% to minimize tail resonance.

***CAUTION***

On slippery surfaces, be prepared to counter nose-right rotation with left pedal as governor increases RPM.

***NOTE***

Before takeoff, pilot should uncover one ear and listen for any unusual noise which may indicate impending failure of a bearing or other component.

**TAKEOFF PROCEDURE**

1. Verify doors latched, governor ON, and RPM stabilized at 102 to 104%.
2. Clear area. Slowly raise collective until aircraft is light on skids. Reposition cyclic as required for equilibrium, then gently lift aircraft into hover.
3. Check gages in green and adjust carb heat if required.
4. Lower nose and accelerate to climb speed following profile shown by height-velocity diagram in Section 5. If RPM drops below 102%, lower collective.

**CRUISE**

1. Adjust carb heat if required. (See page 4-11.)
2. Verify RPM near top of green arc.
3. Set manifold pressure as desired with collective. Observe MAP and airspeed limits.
4. Pull RT TRIM knob.
5. Verify gages in green, warning lights out.

***CAUTION***

In turbulence, reduce power and use a slower than normal cruise speed. If turbulence is significant or becomes uncomfortable for the pilot, use 60 to 70 KIAS.

***CAUTION***

Exercise extreme care never to inadvertently pull mixture control as engine stoppage will result.

***CAUTION***

In-flight leaning with engine mixture control is not recommended. Engine stoppage may result as there is no propeller to keep engine turning should overleaning occur.

**DOORS-OFF OPERATION**

Avoid removing left door to protect tail rotor from loose objects. If left door must be removed, warn passenger to secure loose objects and to keep head and arms inside cabin to avoid high velocity airstream.

**PRACTICE AUTOROTATION - POWER RECOVERY**

1. Adjust carb heat if required. (See page 4-11.)
2. Lower collective to down stop and adjust throttle as required for small tachometer needle separation.

***CAUTION***

To avoid inadvertent engine stoppage, do not chop throttle to simulate a power failure. Always roll throttle off smoothly for small visible needle split.

***NOTE***

Governor is inactive below 80% engine RPM regardless of governor switch position.

***NOTE***

When entering autorotation from above 4000 feet, reduce throttle slightly before lowering collective to prevent engine overspeed.

3. Adjust collective to keep rotor RPM in green arc and adjust throttle for small needle separation.
4. Keep airspeed 60 to 70 KIAS.
5. At about 40 feet AGL, begin cyclic flare to reduce rate of descent and forward speed.
6. At about 8 feet AGL, apply forward cyclic to level aircraft and raise collective to control descent. Add throttle if required to keep RPM in green arc.

**PRACTICE AUTOROTATION - POWER RECOVERY (Cont'd)**

***CAUTION***

Simulated engine failures require prompt lowering of collective to avoid dangerously low rotor RPM. Catastrophic rotor stall could occur if the rotor RPM ever drops below 80% plus 1% per 1000 feet of altitude.

**PRACTICE AUTOROTATION - WITH GROUND CONTACT**

If practice autorotations with ground contact are required for demonstration purposes, perform in same manner as power recovery autorotations except:

Prior to cyclic flare, roll throttle off into overtravel spring and hold it against hard stop until autorotation is complete. (This prevents throttle correlator from adding power when collective is raised.)

Always contact ground with skids level and nose straight ahead.

***CAUTION***

The R22 has a light, low-inertia rotor system. Most of the energy required for an autorotation is stored in the forward momentum of the aircraft, not in the rotor. Therefore, a well-timed cyclic flare is required and rotor RPM must be kept in the green until just before ground contact.

***NOTE***

Have landing gear skid shoes inspected frequently when practicing autorotations with ground contact. Rapid wear of skid shoes may occur.

## **USE OF CARBURETOR HEAT**

Carburetor ice can form in a wide range of atmospheric conditions, but is most likely to form when OAT is between -4°C and 30°C (25°F and 86°F) and the difference between OAT and dew point is less than 15C° (27F°). When conditions conducive to carburetor ice are suspected, use carburetor heat as follows:

During Run-up: Use full carburetor heat (it is filtered) during warm-up to preheat induction system.

During Takeoff, Climb, and Cruise: Use carb heat as required to keep CAT gage indication out of yellow arc.

During Descent and Autorotation: At power settings below 18 inches MAP, apply full carb heat regardless of CAT gage indication. CAT gage does not indicate correct carburetor temperature below 18 inches MAP.

### ***CAUTION***

The pilot may be unaware of carburetor ice formation as the governor will automatically increase throttle and maintain constant manifold pressure and RPM. Therefore, the pilot must apply carburetor heat as required whenever icing conditions are suspected.

## **USE OF CARB HEAT ASSIST**

A carburetor heat assist device is installed on R22s with O-360 engines. The carb heat assist correlates application of carburetor heat with changes in collective setting to reduce pilot work load. Lowering collective mechanically adds heat and raising collective reduces heat. A friction clutch allows the pilot to override the system and increase or decrease heat as required.

A latch is provided at the control knob to lock carburetor heat off. The knob should be left unlatched unless it is obvious that conditions are not conducive to carburetor ice. Apply carburetor heat as required if carburetor ice is a possibility. Monitor CAT gage and readjust as necessary following lift to hover or any power change.

**DESCENT, APPROACH, AND LANDING**

1. Reduce power with collective as desired. Adjust carb heat as required. Observe airspeed limits.

***CAUTION***

Do not initiate a descent with forward cyclic. This can produce a low-G condition. Always initiate a descent by lowering collective.

2. Make final approach into wind at lowest practical rate of descent with initial airspeed of 60 knots.
3. Reduce airspeed and altitude smoothly to hover. (Be sure rate of descent is less than 300 FPM before airspeed is reduced below 30 KIAS.)
4. From hover, lower collective gradually until ground contact.
5. After initial ground contact, lower collective to full down position.

***CAUTION***

When landing on a slope, return cyclic control to neutral before reducing rotor RPM.

***CAUTION***

Never leave helicopter flight controls unattended while engine is running.

***CAUTION***

Hold throttle closed if passenger is entering or exiting with engine running and left seat collective installed.

**SHUTDOWN PROCEDURE**

Collective down, RPM 70-75% . . . . . Friction ON  
Cyclic and pedals neutral . . . . . Friction ON  
CHT drop . . . . . Throttle closed  
Clutch switch . . . . . Disengage  
Wait 30 seconds . . . . . Mixture OFF  
Mixture guard . . . . . Back on mixture  
Wait 30 seconds . . . . . Apply rotor brake  
Clutch light . . . . . Extinguishes  
Avionics, alt, battery, and ignition switches . . . . . OFF

***CAUTION***

Do not slow rotor by raising collective during shutdown. Blades may flap and strike tailcone.

***NOTE***

During idle and after engine shutdown, pilot should uncover one ear and listen for unusual noise which may indicate impending failure of a bearing or other component.

### **NOISE ABATEMENT**

To improve the quality of our environment and to dissuade overly restrictive ordinances against helicopters, it is imperative that every pilot minimize noise irritation to the public. Following are several techniques which should be employed when possible.

1. Avoid flying over outdoor assemblies of people. When this cannot be avoided, fly as high as practical, preferably over 2000 feet AGL.
2. Avoid blade slap. Blade slap usually occurs during shallow high-speed descents, especially during turns. It can be avoided by using slower, steeper descents. With the right door removed, the pilot can easily determine those flight conditions which produce blade slap and develop piloting techniques to eliminate or reduce it.
3. When departing from or approaching a landing site, avoid prolonged flight over noise-sensitive areas. Always fly above 500 feet AGL and preferably above 1000 feet AGL.
4. Repetitive noise is far more irritating than a single occurrence. If you must fly over the same area more than once, vary your flight path to not overfly the same buildings each time.
5. When overflying populated areas, look ahead and select the least noise-sensitive route.

#### ***NOTE***

Above procedures do not apply where they would conflict with Air Traffic Control clearances or instructions or when, in the pilot's judgment, they would result in an unsafe flight path.



**INFORMATION PER FAA AD 95-26-04**

Until the FAA completes its research into the conditions and aircraft characteristics that lead to main rotor blade/fuselage contact accidents, and corrective type design changes and operating limitations are identified, Model R22 pilots are strongly urged to become familiar with the following information and comply with these recommended procedures:

Main Rotor Stall: Many factors may contribute to main rotor stall and pilots should be familiar with them. Any flight condition that creates excessive angle of attack on the main rotor blades can produce a stall. Low main rotor RPM, aggressive maneuvering, high collective angle (often the result of high-density altitude, over-pitching [exceeding power available] during climb, or high forward airspeed) and slow response to the low main rotor RPM warning horn and light may result in main rotor stall. The effect of these conditions can be amplified in turbulence. Main rotor stall can ultimately result in contact between the main rotor and airframe. Additional information on main rotor stall is provided in the Robinson Helicopter Company Safety Notices SN-10, SN-15, SN-20, SN-24, SN-27, and SN-29.

Mast Bumping: Mast bumping may occur with a teetering rotor system when excessive main rotor flapping results from low "G" (load factor below 1.0) or abrupt control input. A low "G" flight condition can result from an abrupt cyclic pushover in forward flight. High forward airspeed, turbulence, and excessive sideslip can accentuate the adverse effects of these control movements. The excessive flapping results in the main rotor hub assembly striking the main rotor mast with subsequent main rotor system separation from the helicopter.

To avoid these conditions, pilots are strongly urged to follow these recommendations:

- 1) Maintain cruise airspeeds between 60 KIAS and less than  $0.9 V_{NE}$ , but no lower than 57 KIAS.
- 2) Use maximum "power-on" RPM at all times during powered flight.
- 3) Avoid sideslip during flight. Maintain in-trim flight at all times.
- 4) Avoid large, rapid forward cyclic inputs in forward flight, and abrupt control inputs in turbulence.

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