SECTION 4

NORMAL PROCEDURES

CONTENTS

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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 ground handling wheels and 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 rivets and 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 Doors

Battery switch . . . . . ON
Oil pressure and alternator lights . . . . . ON
Warning light test switches . . . . . Push to test
EMU (if installed) . . . . . Check status
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 secure
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 . . . . . Secure
Tail rotor control . . . . . No interference
Cowl doors . . . . . 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 . . . . . 1.5 inches (4 cm) maximum
Sprag clutch . . . . . No leaks
Upper bearing . . . . . No leaks
Telatemp – upper bearing . . . . . Normal

DAILY OR PREFLIGHT CHECKS (cont'd)

2. Engine Right Side (cont'd)
   - Upper Sheave Condition . . . . . Check
   - Lower sheave groove wear . . . . . Smooth & Uniform
   - Flex coupling . . . . . No cracks, nuts secure
   - 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
   - Teletemps – lower bearing . . . . . Normal
   - Lower bearing . . . . . No leaks

4. Empennage
   - Tail surfaces . . . . . No cracks
   - Fasteners . . . . . Secure
   - 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
   - Skins . . . . . No cracks or dents
   - Strobe light condition . . . . . Check
   - Antenna . . . . . Check

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 here) . . . . . 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

9. Main Rotor

CAUTION

Do not pull down on blades to teeter rotor. To lower a blade, push up on opposite blade.

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
All fasteners . . . . . Secure
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
    - Position light . . . . . Check

11. Nose Section
    - Pitot tube . . . . . Clear
    - Windshield condition and cleanliness . . . . . Check
    - Landing lights . . . . . Check
    - Yaw string . . . . . Check

12. Fuselage Right Side
    - Landing gear . . . . . Check
    - 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
Audio alert (if equipped) . . . . . Test
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 (if installed) . . . . . 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

For aircraft which provide low RPM horn through the audio system, a headset for each pilot is required to hear the horn.

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.

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 reduce throttle as desired for tachometer needle separation.

CAUTION

To avoid inadvertent engine stoppage, do not chop throttle to simulate a power failure. Always roll throttle off smoothly. Recover immediately if engine is rough or engine RPM continues to drop.

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 within limits and adjust throttle for tachometer 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

NOTE

If ambient temperature is above 100°F (38°C), cool down at 70-75% RPM for at least one minute before reducing to idle.

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.

CAUTION

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

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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