

**SECTION 7
SYSTEMS DESCRIPTION**

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SECTION 7

SYSTEMS DESCRIPTION

GENERAL

The R22 is a two-place, single main rotor, single engine helicopter constructed primarily of metal and equipped with skid-type landing gear.

The primary fuselage structure is welded steel tubing and riveted aluminum sheet. The tailcone is a monocoque structure in which aluminum skins carry primary loads. Fiberglass and thermoplastics are used in the secondary cabin structure, engine cooling shrouds, and various other ducts and fairings. The cabin doors are also constructed of fiberglass and thermoplastics.

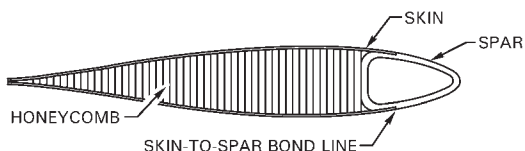
A right-side cowl door provides access to the main gearbox and drive system. Additional access to controls and other components for maintenance is provided by removable panels and cowlings.

Stainless steel firewalls are located forward of and above the engine.

Both cabin doors are removable. Refer to Section 8 for removal and installation procedures.

ROTOR SYSTEMS

The main rotor has two all-metal blades mounted to the hub by coning hinges. The hub is mounted to the shaft by a teeter hinge. The coning and teeter hinges use self-lubricated bearings. Droop stops for the main rotor blades provide a teeter hinge friction restraint which normally prevents the rotor from teetering while stopping or starting. Pitch change bearings for each blade are enclosed in a housing at the blade root. The housing is filled with oil and sealed with an elastomeric boot. Each blade has a thick stainless steel spar at the leading edge which is resistant to corrosion and erosion. The skins are bonded to the spar approximately one inch aft of the leading edge. Blades must be refinished if the paint erodes to bare metal at the skin-to-spar bond line. Bond may be damaged if bond line is exposed.



MAIN ROTOR BLADE CONSTRUCTION

The tail rotor has two all-metal blades and a teetering hub with a fixed coning angle. The pitch change bearings have self-lubricated liners. The teeter hinge bearings are elastomeric or have self-lubricated liners. The tail rotor blades are constructed with aluminum skins and root fittings. Maintaining the paint finish will reduce corrosion and erosion.

DRIVE SYSTEM

A vee-belt sheave is bolted directly to the engine output shaft. Vee-belts transmit power to the upper sheave which has an overrunning clutch contained in its hub. The inner shaft of the clutch transmits power forward to the main rotor and aft to the tail rotor. Flexible couplings are located at the main gearbox input and at each end of the long tail rotor drive shaft.

The main gearbox contains a single-stage spiral-bevel gear set which is splash lubricated. A cooling duct under the box is connected to the top of the engine shroud. The main gearbox is supported by four rubber mounts.

The long tail rotor drive shaft has no support bearings but has a lightly-loaded damper bearing. The tail gearbox contains a single 90° splash-lubricated spiral-bevel gear set. |

POWERPLANT

One Lycoming four-cylinder, horizontally-opposed, overhead-valve, air-cooled, carbureted engine with a wet sump oil system powers the helicopter. The engine is equipped with a starter, alternator, shielded ignition, two magnetos, muffler, oil cooler, and induction air filter. See Sections 1 and 2 for powerplant specifications and limitations.

A direct-drive, squirrel-cage fan mounted to the engine output shaft supplies cooling air to the cylinders and oil cooler via a fiberglass and aluminum shroud. |

Induction air enters through an inlet on the right side of the fuselage and passes through a flexible duct to the carburetor air box. A hot air scoop supplies heated air to the air box. A sliding valve controlled by the pilot allows either cool or warm air to flow into the box, through the air filter, and up into the carburetor. |

The pilot should read and adhere to procedures recommended in the Lycoming Operator's Manual to obtain maximum engine life and efficiency.

FLIGHT CONTROLS

Dual controls are standard equipment and all primary controls are actuated through push-pull tubes and bellcranks. Bearings used throughout the control system are either sealed ball bearings which do not require lubrication or have self-lubricated liners.

Flight control operation is conventional. The cyclic is center mounted with the left and right control grips mounted to a cross tube which pivots on the center cyclic post. On later aircraft, the pilot's cyclic grip angle can be adjusted fore and aft relative to the cross tube by a mechanic to achieve the most comfortable hand position. The most forward position provides the most control clearance at aft cyclic for larger pilots. Pilots should always verify the ability to apply full control travel prior to flight.

Collective operation is conventional. The engine throttle is correlated to collective inputs through a mechanical linkage. When the collective is raised, the throttle is opened and when the collective is lowered, the throttle is closed. The collective stick also incorporates a twist grip throttle control which is described in the Engine Controls section.

CAUTION

Above 4000 feet, throttle-collective correlation and governor are less effective. Therefore, power changes should be slow and smooth.

CAUTION

At high power settings above 4000 feet, the throttle is frequently wide open and RPM must be controlled with collective.

REMOVABLE FLIGHT CONTROLS

Left seat pilot controls may be removed and installed by maintenance personnel or pilots as follows:

1. To remove cyclic grip, remove quick-release pin by depressing button and pulling, then pull outward on left grip while supporting cyclic center post. To install removable cyclic grip, use reverse procedure.

NOTE

Later aircraft have a knurled ring next to the quick-release pin which may be hand tightened to eliminate freeplay. The ring must be loose (rotate counterclockwise looking inboard) to remove pin.

CAUTION

After removing cyclic grip, place plastic cap on exposed cyclic cross tube to prevent possible injury to left seat passenger.

2. To remove collective, push boot aft to expose locking pins. Depress locking pins and pull forward on stick. To install, use reverse procedure. It may be necessary to rotate stick slightly to allow pins to snap into place.

CAUTION

When collective is installed, ensure that both locking pins are fully engaged through holes on each side.

3. To remove tail rotor pedals, depress locking pin while twisting pedal counterclockwise, then pull up. To install, use reverse procedure.

RPM GOVERNOR

The governor maintains engine RPM by sensing changes and applying corrective throttle inputs through a friction clutch which can be easily overridden by the pilot. The governor is active only above 80% engine RPM and can be switched on or off using the toggle switch on the end of the right seat collective.

The governor is designed to assist in controlling RPM under normal conditions. It may not prevent over- or under-speed conditions generated by aggressive flight maneuvers.

CAUTION

When operating at high density altitudes, governor response rate may be too slow to prevent overspeed during gusts, pull-ups, or when lowering collective.

CONTROL TRIM AND FRICTION

Balancing trim springs are incorporated in the cyclic and collective controls. The collective-up spring balances the rotor loads, allowing the pilot to remove his left hand from the collective during most flight regimes. The longitudinal cyclic has a fixed bungee spring which cancels most longitudinal stick forces during cruise flight.

The lateral cyclic is equipped with an on-off trim spring to cancel the left stick force which occurs during high speed flight. The spring is actuated by a push-pull knob located just forward of the cyclic stick. For S/N 550 and subsequent, fine adjustment of the trim force is controlled by the knob located on the left side of the console.

CAUTION

If mixture control is inadvertently pulled in flight, engine stoppage will result. To avoid pulling wrong control, always reach around left side of cyclic center post to actuate lateral trim.

Cyclic and collective controls are equipped with adjustable friction devices. The collective friction lever is located near the aft end of the pilot's collective stick. It is actuated aft to increase friction and forward to release it.

The cyclic friction knob is located left of the cyclic center post. Turning the knob clockwise applies friction to both longitudinal and lateral cyclic.

CAUTION

Control friction must be used with caution during flight. Excessive friction may make the helicopter difficult to control.

The pedals actuate push-pull controls connected directly to the tail rotor pitch control and do not incorporate any trim spring or friction devices.

ENGINE CONTROLS

A twist-grip throttle control is located on each collective stick. The controls are interconnected and actuate the throttle valve through a mechanical linkage. The engine throttle is also correlated to collective inputs through a mechanical linkage. When the collective is raised, the throttle is opened and when the collective is lowered, the throttle is closed.

The electronic engine governor makes minor throttle adjustments by rotating the twist grip to maintain RPM within power-on limits. Manual manipulation of the twist grip is not typically required except during start up, shut down, autorotation practice, and emergencies.

An overtravel spring located in the throttle linkage allows the pilot to roll throttle off beyond the idle stop prior to a ground contact (run-on) autorotation landing. This prevents the throttle from opening when the collective is raised.

Correct throttle linkage adjustment may be verified during preflight by rolling the twist-grip through the overtravel spring and holding against the hard idle stop. The carburetor throttle arm should just barely start to move when the collective is raised full up.

Other engine controls include a mixture control located forward and to the right of the cyclic center post and a carburetor heat control located to the right and aft of the cyclic. R22s with O-360 engines are equipped with Carb Heat Assist which is described in Section 4.

CAUTION

In-flight leaning with mixture control is not recommended. If mixture is leaned on the ground at high altitude, be sure it is pushed back in before descending to lower altitude. Otherwise, engine may quit.

NOTE

On some aircraft, the mixture control is located on the console face. The mixture guard is not used with this mixture control.

CLUTCH ACTUATOR

After the engine is started, it is coupled to the rotor drive system through vee-belts which are tensioned by raising the upper drive sheave. An electric actuator, located between the drive sheaves, raises the upper sheave when the pilot engages the clutch switch. The actuator senses compressive load (belt tension) and switches off when the vee-belts are properly tensioned. The clutch caution light illuminates whenever the actuator circuit is energized, either engaging, disengaging, or retensioning the belts. The light stays on until the belts are properly tensioned or completely disengaged.

Belt slack during engine start should be adjusted such that blades begin turning within five seconds of clutch engagement. Excessive slack may cause belts to jump out of sheave grooves during start. Periodic readjustment by a mechanic may be required as belts wear in service.

A fuse located on or near the test switch panel prevents an actuator motor overload from tripping the circuit breaker. If the fuse blows, the actuator motor will stop but the clutch caution light will remain illuminated. An open circuit breaker removes power from both the motor and the light. With an open circuit breaker, no belt tensioning will occur, and the light will not function to indicate an abnormal condition.

CAUTION

Never take off while clutch caution light is on.

FUEL SYSTEM

The fuel system is gravity-flow (no fuel pumps) and includes a main tank, an optional auxiliary tank, a shutoff valve control located behind the left seat, and a strainer (gascolator). Fuel tanks on later aircraft have flexible bladders in aluminum enclosures while earlier aircraft use all-aluminum tanks. Fuel tank air vents are located inside the mast fairing.

Plunger-style drain valves are provided for the gascolator and for each fuel tank sump. The gascolator is located on the lower left side of the firewall. The drain valves for the auxiliary tank and bladder-style main tank are located inside the cowl door below the auxiliary tank. Plastic tubes attached to the valves allow fuel to be drained overboard. Fuel samples are taken by pushing on the plunger(s). For all-aluminum main tanks, the drain is located on the left side of the fuselage and is opened by pushing in on the plastic tube. On newer helicopters, a glass tube stowed inside the upper, aft cowl door is provided which may be used to catch the fuel samples. Fuel should be sampled from all three locations prior to the first flight of the day and after refueling to verify no contamination and correct grade.

The fuel gages are electrically operated by float-type transmitters in the tanks. When the gages read E the tanks are empty except for a small quantity of unusable fuel. The low fuel caution light is actuated by a separate electric sender located on the bottom of the main tank.

The auxiliary tank is interconnected with the main tank and is located somewhat higher so it will become empty first while fuel still remains in the main tank. The fuel shutoff valve controls flow from both tanks to the engine.

ELECTRICAL SYSTEM

A 14-volt DC electrical system which includes an alternator and a sealed lead-acid battery is standard. The battery is located either in the engine compartment or beneath the instrument console.

The circuit breaker panel is on the ledge just forward of the left seat. Breakers are marked to indicate function and amperage. Inflight reset of circuit breakers is not recommended.

The battery switch controls the battery relay which disconnects the battery from the electrical system. A wire protected by a fuse near the battery bypasses the battery relay to allow both tachometers and the clock to continue to receive battery power with the battery switch off.

The alternator control unit protects the electrical system from overvoltage conditions. The ammeter indicates current to the battery ("—" indicates discharge). An ALT caution light or ammeter discharge indication in flight indicates low voltage and possible alternator failure. Turn off nonessential electrical equipment and switch alternator off then back on after one second to reset alternator control unit. If ALT light stays on or ammeter still indicates discharge, land as soon as practical.

CAUTION

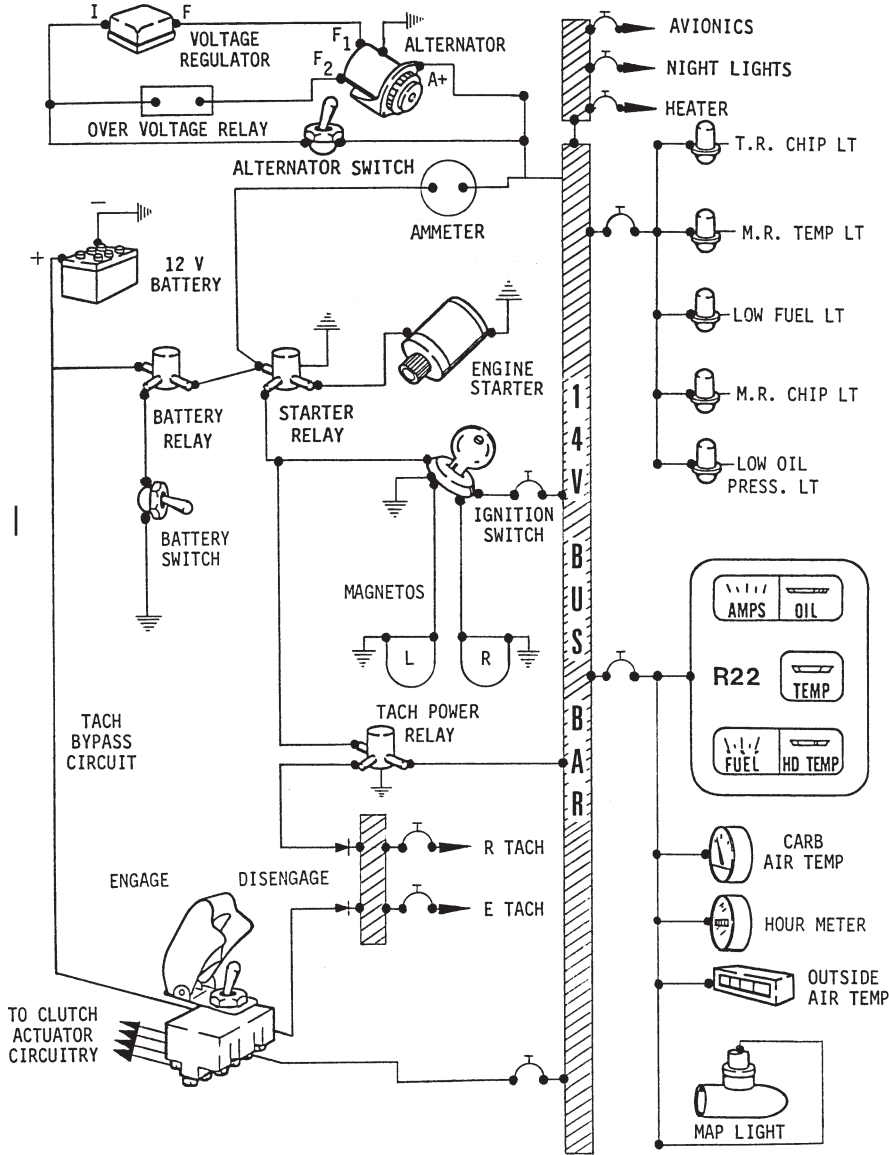
Continued flight without functioning alternator can result in loss of power to tachometers, producing a hazardous flight condition.

NOTE

Except for emergency procedures, do not operate alternator with battery switched off. The battery helps protect electrical equipment from voltage spikes.

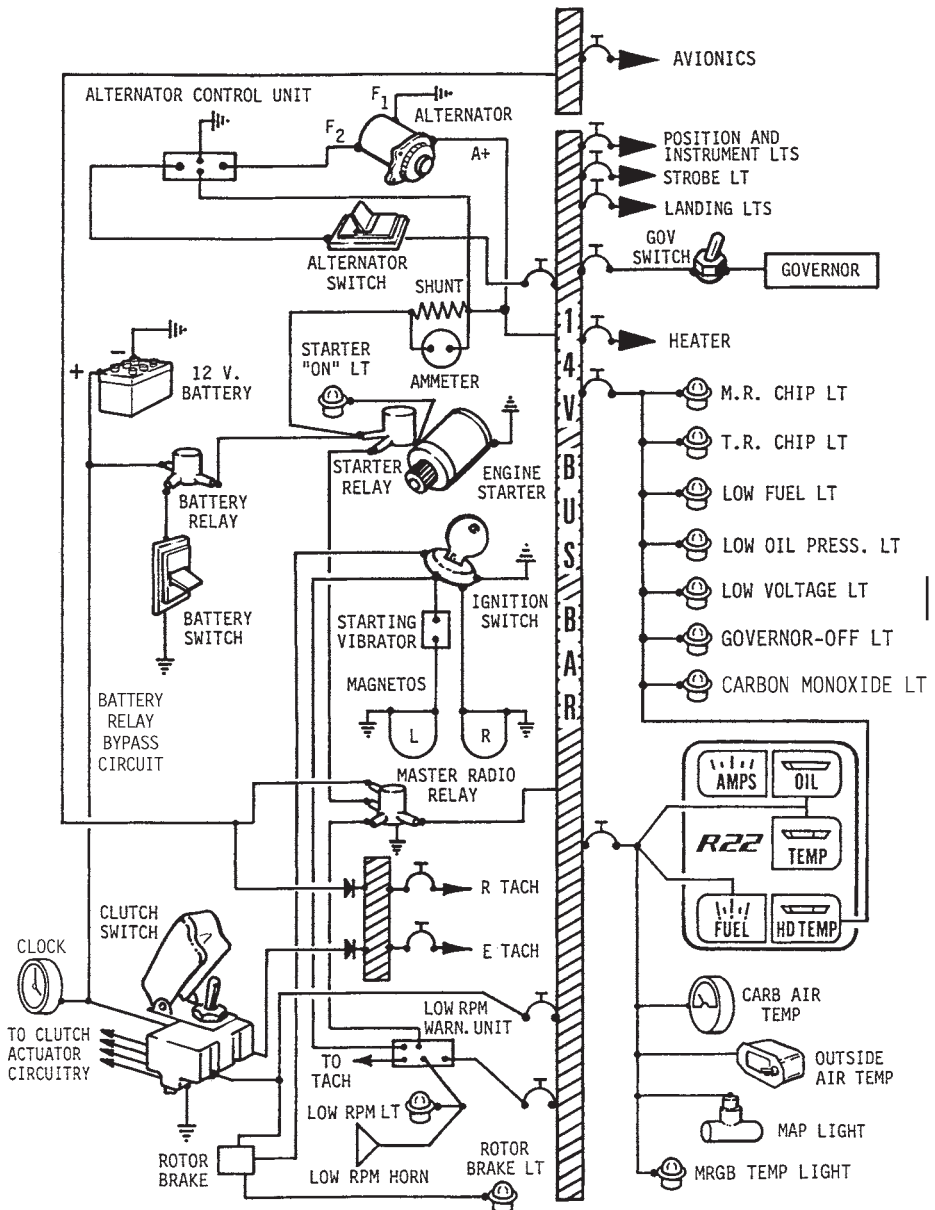
Later aircraft have an avionics master switch which controls power to the avionics bus. This allows all avionics to be switched on and off by a single switch.

ELECTRICAL SYSTEM (cont'd)



ELECTRICAL SYSTEM
R22 STANDARD & HP

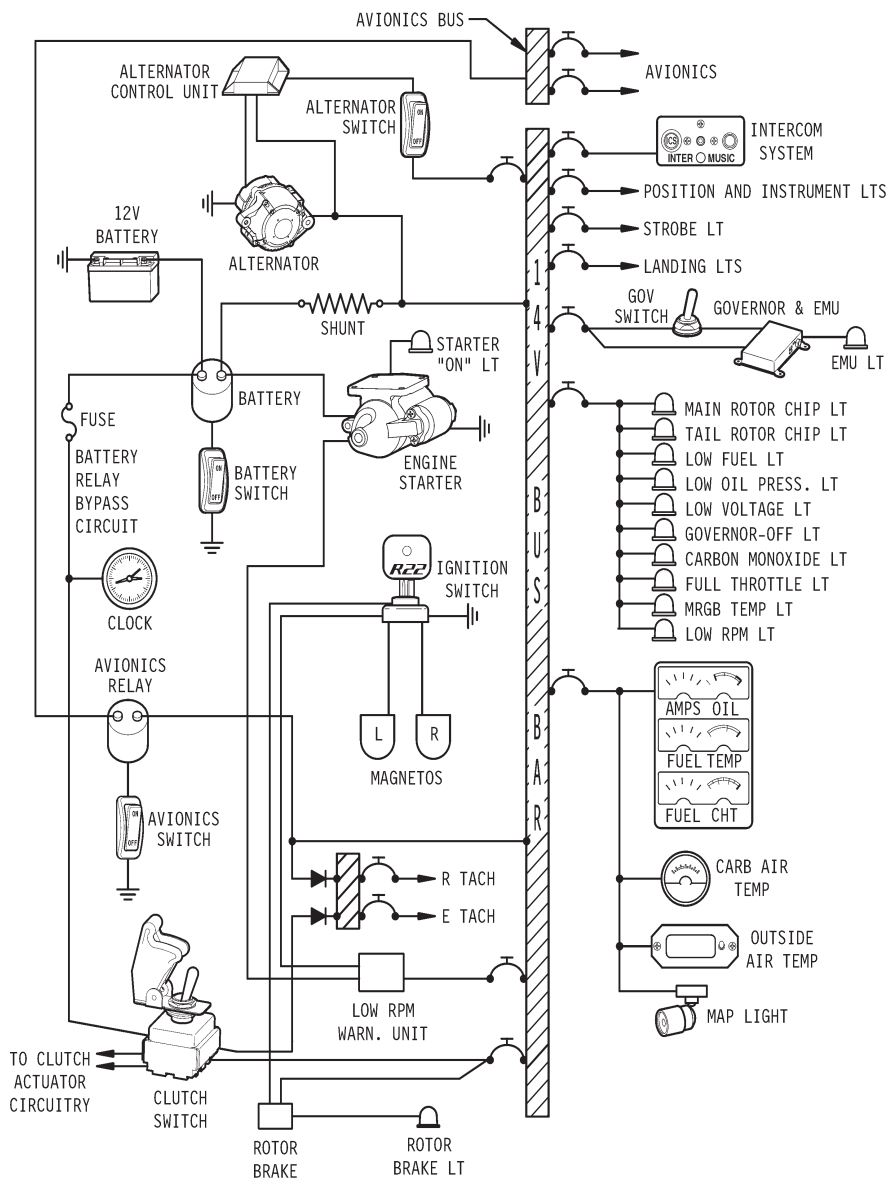
ELECTRICAL SYSTEM (cont'd)



ELECTRICAL SYSTEM

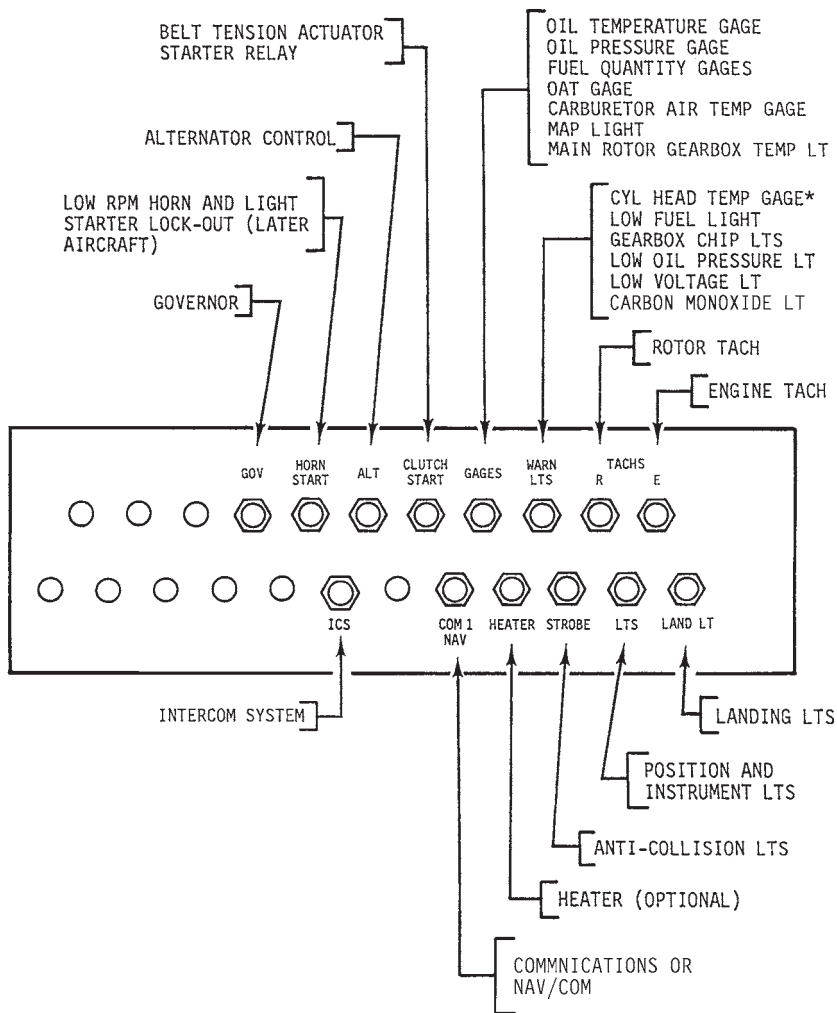
ALPHA, BETA, & EARLIER BETA II

ELECTRICAL SYSTEM (cont'd)



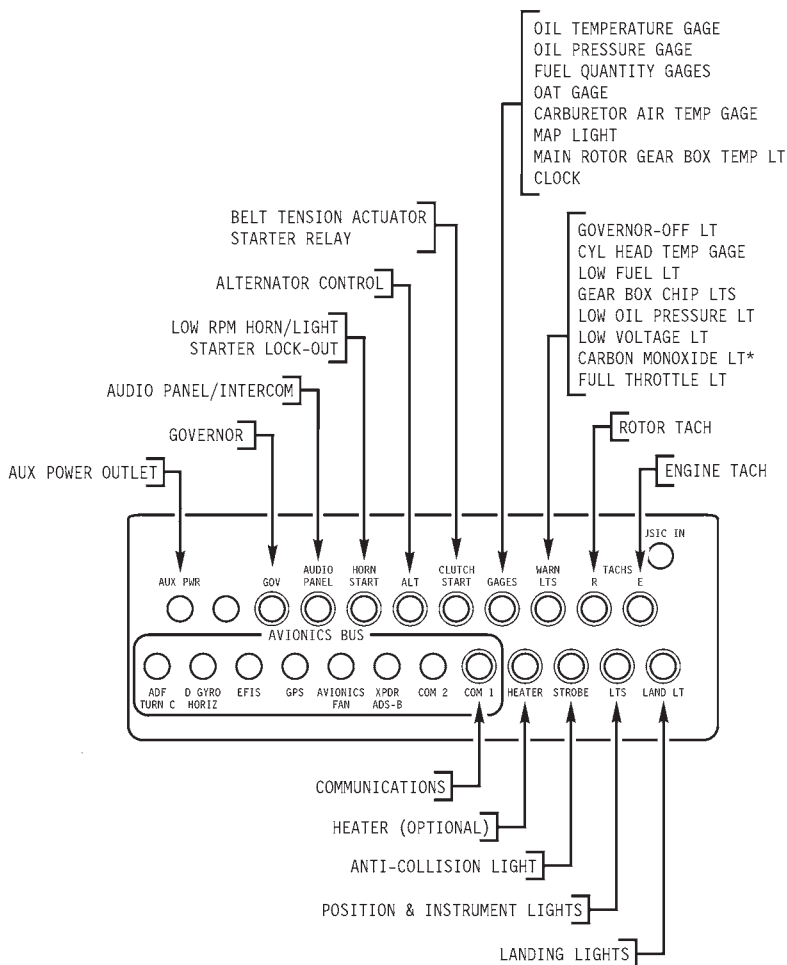
**ELECTRICAL SYSTEM
LATER BETA II**

ELECTRICAL SYSTEM (cont'd)



CIRCUIT BREAKER PANEL – TYPICAL (EARLIER AIRCRAFT)

ELECTRICAL SYSTEM (cont'd)



CIRCUIT BREAKER PANEL – TYPICAL (LATER AIRCRAFT)

LIGHTING SYSTEM

A red anti-collision light is installed on the tailcone and is controlled by the strobe switch. Position lights are installed on each side of the cabin and in the tail and are controlled by the nav lights switch. Post and internal lights (earlier aircraft) or a light at the top of the windshield (later aircraft) illuminate the instruments. Instrument lighting is active when the nav lights switch is on and lighting is dimmed via the knob above the nav lights switch. An overhead map light mounted on a swivel is controlled by an adjacent switch. The map light may be used for emergency lighting of the instrument panel.

Two landing lights are installed in the nose at different vertical angles to increase the lighted area. One landing light switch controls both lights and is located on the cyclic center post.

NOTE

Landing lights operate only when clutch actuator switch is in the engage position.

NOTE

Continuous operation of landing and position lights in flight is recommended to promote collision avoidance.

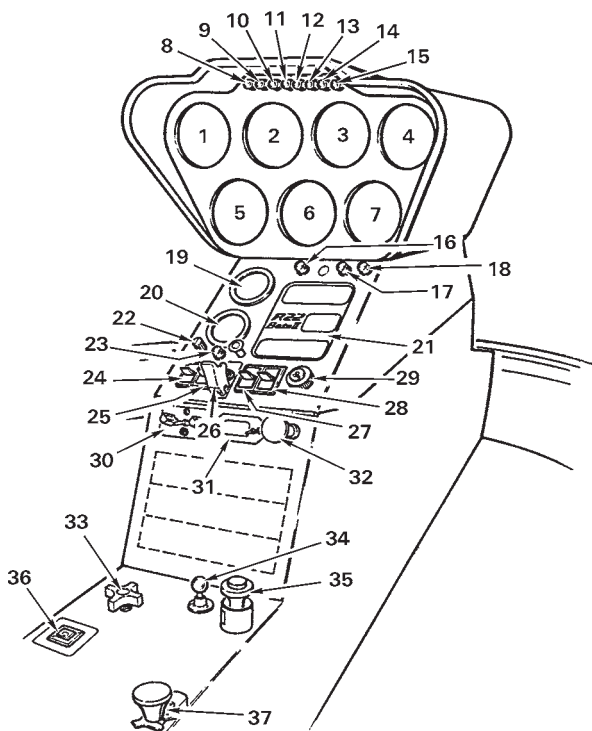
INSTRUMENT PANEL

Standard primary instruments include an airspeed indicator, engine and rotor dual tachometer, altimeter, manifold pressure gage, and magnetic compass. Engine gages include an ammeter, oil pressure, oil temperature, cylinder head temperature, and fuel quantity for main and aux (if installed) tanks. Also standard are a clock, a carburetor air temperature gage, and a digital outside air temperature gage. An hourmeter is located on the ledge just forward of the pilot's seat.

Views of typical instrument panels are given on the following pages. Pilots should familiarize themselves with panel layout and equipment installations for each specific aircraft that they fly.

OPTIONAL AVIONICS

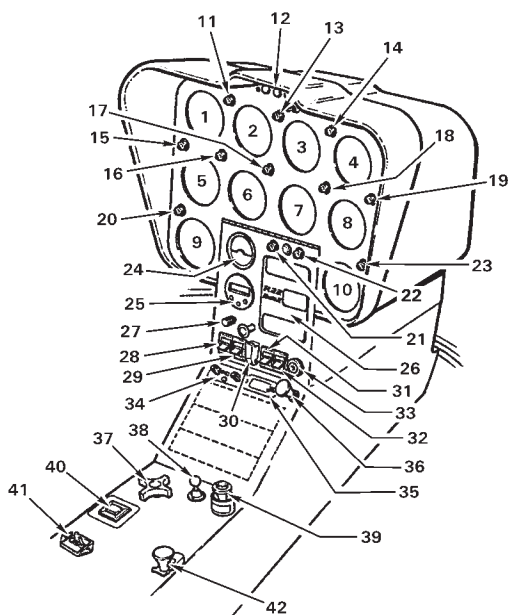
A wide range of optional avionics are available for the R22. It is not practical to provide a description of all equipment in this manual. All aircraft are delivered with the manufacturers' operating manuals for each piece of installed equipment. Pilots are referred to the manufacturers' manuals for detailed operating instructions. Additional information for more complex options such as primary flight displays (PFDs) may be found in the Optional Avionics Supplement in Section 9. Good practice dictates becoming familiar with installed equipment before operating an aircraft.



- | | |
|-----------------------------|--------------------------------|
| 1. VERTICAL SPEED INDICATOR | 20. CARB AIR TEMP OR CLOCK |
| 2. OPTIONAL INSTRUMENT | 21. ENGINE INSTRUMENTS |
| 3. AIRSPEED INDICATOR | 22. PANEL LIGHTS DIMMER |
| 4. ENGINE AND ROTOR TACHS | 23. ROTOR BRAKE LIGHT |
| 5. ALTIMETER | 24. NAVIGATION LIGHTS SWITCH |
| 6. OPTIONAL INSTRUMENT | 25. STROBE LIGHT SWITCH |
| 7. MANIFOLD PRESSURE GAGE | 26. CLUTCH ACTUATOR SWITCH |
| 8. CLUTCH ACTUATOR LIGHT | 27. ALTERNATOR SWITCH |
| 9. M.R. GEARBOX TEMP LIGHT | 28. BATTERY SWITCH |
| 10. M.R. GEARBOX CHIP LIGHT | 29. IGNITION SWITCH |
| 11. CARBON MONOXIDE LIGHT | 30. INTERCOM |
| 12. STARTER-ON LIGHT | 31. OUTSIDE AIR TEMP/VOLTMETER |
| 13. T.R. GEARBOX CHIP LIGHT | 32. CABIN AIR |
| 14. LOW FUEL LIGHT | 33. CYCLIC FRICTION |
| 15. LOW RPM LIGHT | 34. CYCLIC RIGHT TRIM |
| 16. ALT LOW VOLTAGE LIGHT | 35. MIXTURE CONTROL |
| 17. OIL PRESSURE LIGHT | 36. ELT SWITCH (OPTIONAL) |
| 18. GOVERNOR-OFF LIGHT | 37. CARBURETOR HEAT |
| 19. CLOCK OR CARB AIR TEMP | |

INSTRUMENT PANEL – TYPICAL (EARLIER AIRCRAFT)

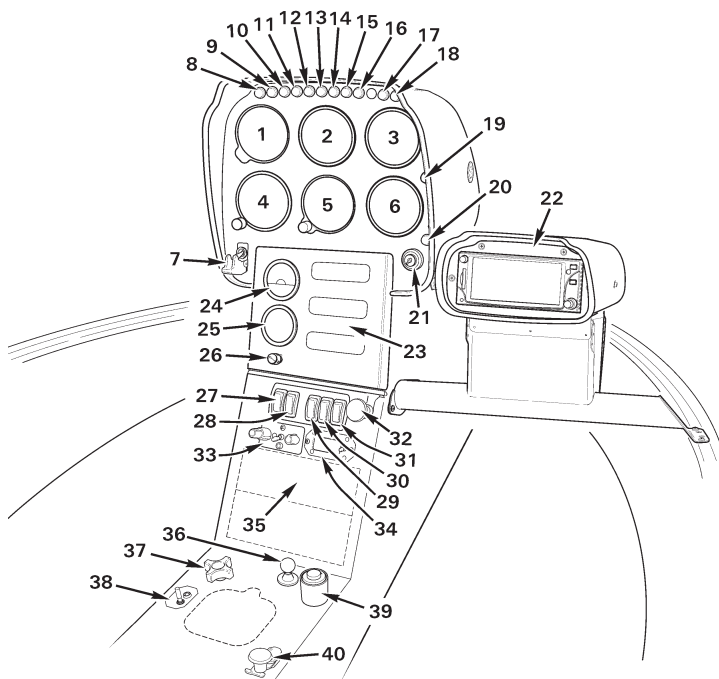
(Exact panel configuration may vary with optional equipment and date of helicopter manufacture.)



- | | |
|-----------------------------|------------------------------|
| 1. ENGINE AND ROTOR TACHS | 22. OIL PRESSURE LIGHT |
| 2. AIRSPEED INDICATOR | 23. ROTOR BRAKE LIGHT |
| 3. ARTIFICIAL HORIZON | 24. CARBURETOR AIR TEMP |
| 4. ALTIMETER | 25. CLOCK |
| 5. MANIFOLD PRESSURE GAGE | 26. ENGINE INSTRUMENTS |
| 6. TURN COORDINATOR | 27. PANEL LIGHTS DIMMER |
| 7. HSI | 28. NAVIGATION LIGHTS SWITCH |
| 8. VERTICAL SPEED INDICATOR | 29. STROBE LIGHT SWITCH |
| 9. OPTIONAL INSTRUMENT | 30. CLUTCH ACTUATOR SWITCH |
| 10. OPTIONAL INSTRUMENT | 31. ALTERNATOR SWITCH |
| 11. M.R. GEARBOX TEMP LIGHT | 32. BATTERY SWITCH |
| 12. MARKER BEACON | 33. IGNITION SWITCH |
| 13. T.R. GEARBOX CHIP LIGHT | 34. INTERCOM |
| 14. M.R. GEARBOX CHIP LIGHT | 35. OUTSIDE AIR TEMP |
| 15. STARTER-ON LIGHT | 36. CABIN AIR |
| 16. LOW RPM LIGHT | 37. CYCLIC FRICTION |
| 17. LOW FUEL LIGHT | 38. CYCLIC RIGHT TRIM |
| 18. CARBON MONOXIDE LIGHT | 39. MIXTURE CONTROL |
| 19. CLUTCH ACTUATOR LIGHT | 40. ELT SWITCH (OPTIONAL) |
| 20. GOVERNOR-OFF LIGHT | 41. HSI SLAVE CONTROL |
| 21. ALT LOW VOLTAGE LIGHT | 42. CARBURETOR HEAT |

OPTIONAL INSTRUMENT PANEL (EARLIER AIRCRAFT)

(Exact panel configuration may vary with optional equipment and date of helicopter manufacture.)



- | | |
|-----------------------------|----------------------------------|
| 1. VERTICAL SPEED INDICATOR | 21. IGNITION SWITCH |
| 2. AIRSPEED INDICATOR | 22. PILOT'S SIDE CONSOLE (OPT'L) |
| 3. ENGINE AND ROTOR TACHS | 23. ENGINE INSTRUMENTS |
| 4. OPTIONAL INSTRUMENT | 24. CARBURETOR AIR TEMP |
| 5. ALTIMETER | 25. CLOCK |
| 6. MANIFOLD PRESSURE GAGE | 26. PANEL LIGHTS DIMMER |
| 7. CLUTCH ACTUATOR SWITCH | 27. NAVIGATION LIGHTS SWITCH |
| 8. CLUTCH ACTUATOR LIGHT | 28. ANTI-COLLISION LIGHT SWITCH |
| 9. M.R. GEARBOX TEMP LIGHT | 29. AVIONICS MASTER SWITCH |
| 10. M.R. GEARBOX CHIP LIGHT | 30. ALTERNATOR SWITCH |
| 11. CARBON MONOXIDE LIGHT | 31. BATTERY SWITCH |
| 12. STARTER-ON LIGHT | 32. CABIN AIR |
| 13. T.R. GEARBOX CHIP LIGHT | 33. INTERCOM |
| 14. LOW FUEL LIGHT | 34. OUTSIDE AIR TEMP/VOLTMETER |
| 15. LOW RPM LIGHT | 35. AVIONICS STACK |
| 16. ALT LOW VOLTAGE LIGHT | 36. CYCLIC RIGHT TRIM |
| 17. OIL PRESSURE LIGHT | 37. CYCLIC FRICTION |
| 18. GOVERNOR-OFF LIGHT | 38. ELT SWITCH (OPTIONAL) |
| 19. FULL THROTTLE LIGHT | 39. MIXTURE CONTROL |
| 20. ROTOR BRAKE LIGHT | 40. CARBURETOR HEAT |

INSTRUMENT PANEL – TYPICAL (LATER AIRCRAFT)

(Exact panel configuration may vary with optional equipment and date of helicopter manufacture.)

AUDIO SYSTEM

A voice-activated intercom/audio system is standard and is controlled by a small control panel above the avionics stack. The ICS volume knob controls intercom volume but does not affect radio volume. The VOX squelch knob is used to set the threshold volume at which the intercom is activated. When the VOX knob is turned fully clockwise, keying is required to activate the intercom. Later intercom systems include a music input jack located on the circuit breaker panel. This input is muted when the intercom is active, when transmitting, and during reception of radio signals.

Headset jacks are located in the ceiling near each seat. The cyclic grips are equipped with either transmit and intercom buttons or trigger-style intercom/transmit switches. For the trigger-style switch, the first detent activates the intercom and the second detent transmits. An additional intercom button is located on the left-hand floor or seat support.

Earlier R22s are equipped with an intercom system that operates in either push-to-talk (PTT) or hot mic modes. A toggle switch to the left of the cyclic center post is used to change modes. In PTT mode, the intercom is activated using the intercom buttons.

Audio control panels from several manufacturers are offered as options in place of the standard intercom system. Pilots should consult the manufacturer's operating instructions if an audio panel is installed.

PITOT-STATIC SYSTEM

The pitot-static system supplies air pressure to operate the airspeed indicator, altimeter, and vertical speed indicator. The pitot tube is located on the front edge of the mast fairing. The static source is located inside the aft cowl ing inboard of the cowl door hinge.

Water can be drained from pitot-static lines by removing the plastic drain plugs which are accessible through the inspection panel on the underside of the cabin. Draining lines should only be required if the airspeed indicator or altimeter appears erratic.

Pitot and static sources should be inspected frequently to verify no bugs or other obstructions.

DUAL TACHOMETER

An electronic engine and rotor dual tachometer is standard. Engine tachometer signal is provided by magneto breaker points. Rotor tachometer signal is provided by two magnetic senders at the main gearbox drive yoke. Each tachometer is on a separate circuit with its own circuit breaker. With battery and alternator switches off, the tachometers continue to receive power from the battery through a bypass circuit as long as the clutch actuator switch is in the engage position.

NOTE

Do not stow helicopter with clutch switch engaged. The tachometers are powered with the clutch engaged and will discharge the battery.

WARNING AND CAUTION LIGHTS

Warning and caution lights include clutch, main gearbox over-temperature, main and tail gearbox chip, starter on (later aircraft), low fuel, low RPM, alternator, low oil pressure, rotor brake, governor off, carbon monoxide (aircraft with cabin heater), and full throttle (later aircraft). The clutch light indicates that the clutch actuator is operating. The low RPM light and horn indicate rotor RPM at 97% or below. The low oil pressure and low fuel lights are actuated by sensors in those systems and are independent of the gage indicators. The alternator light warns of a possible alternator failure. The governor-off light indicates the RPM governor is switched off.

The main and tail gearbox chip detectors are magnetic devices located in the drain plug of each gearbox. When metallic particles are drawn to the magnets they close an electrical circuit, illuminating the caution light. Metal particles may be caused by a failing bearing or gear, thus giving warning of impending gearbox failure. The main gearbox over-temp light is actuated by a temperature switch located near the input pinion.

The carbon monoxide light is actuated by a sensor above the pilot's heater outlet and indicates elevated cabin carbon monoxide levels.

The full throttle light is activated by a switch in the throttle linkage and indicates that the engine is near full throttle.

AUDIO ALERTS

All R22 helicopters have a low-RPM horn which sounds when rotor RPM is below 97%. The horn is muted when the collective is fully down. On earlier aircraft, the horn is provided by a speaker in the side of the instrument console. On later aircraft, a tone generator in the audio system provides the horn through crew headsets.

Later aircraft include a high rotor RPM alert through the headsets. A warble tone (high/low tone) indicates rotor RPM is approaching 110%. A test button on the instrument panel permits pre-flight or in-flight testing of the high-RPM alert.

AUDIO ALERTS (Cont'd)

Additional audio alerts may be provided in the headsets depending on optional equipment installed, such as terrain and traffic warnings.

ENGINE MONITORING UNIT

Later aircraft are equipped with an Engine Monitoring Unit (EMU), which is a digital recording device within the engine RPM governor control box. The EMU continuously monitors engine and rotor speed, engine oil temperature, cylinder head temperature, manifold pressure, ambient pressure, and outside air temperature.

EMU status is indicated by an amber light located in the right-side baggage compartment on the aft seat support panel. The EMU requires approximately ten seconds to complete a self-test after the aircraft battery is switched on. Once the self-test is complete, steady illumination of the light means normal EMU operation. A slowly flashing light (once every two seconds) or no light means there is a fault in the EMU's senders or circuitry. A fast flashing light (four times per second) indicates the EMU has detected an exceedance. EMU data can be downloaded to a computer with the appropriate software. A fault or exceedance should be investigated and the indication reset by a qualified mechanic prior to the next flight. Current exceedances may be reviewed (but not reset) on an Apple mobile device using an application available through the Robinson website.

The EMU is intended to be used only as a maintenance aid. It remains the pilot's responsibility to report any observed exceedances.

CABIN HEATING AND VENTILATION

Fresh air vents are located in each door and in the nose. Door vents are opened and closed using the knob near the vent door hinge. On earlier aircraft, pushing in on the knob will seal and lock the door vents closed. On later aircraft, a rotating knob is provided to lock the vents. For maximum ventilation, open door vents wide during hover but only one inch or less during cruise. The rotating knob can be used to hold vents partially open.

The fresh air inlet in the nose is opened by pulling the cabin air knob on the console face. Air from the nose inlet is directed along inside surface of the windshield for defogging as well as for ventilation.

A cabin heater is optional. It consists of a muffler heat shroud, a control valve at the firewall, an outlet grille forward of the tail rotor pedals, and interconnecting ducting. A heater control knob located on the ledge forward of the pilot's seat actuates the valve which directs heat either into the cabin or out an overboard discharge on the cabin underside. Earlier aircraft have an electric blower with a switch next to the control knob to turn the blower on. On later aircraft, heater air is taken from the engine cooling shroud and a blower is not required.

CAUTION

In case of an in-flight engine fire, heater control knob should be pushed off to seal cabin area from engine compartment.

NOTE

On aircraft with a heater blower, have the heater shroud removed during warm seasons to prolong muffler life.

SEATS, BELTS, AND BAGGAGE

The seats are not adjustable but each helicopter is supplied with a removable back cushion to position the pilot farther forward. This allows shorter pilots to reach the pedals, the cyclic grip in its most forward position, and controls on the center console.

Each seat is equipped with a combined lap belt and inertia reel shoulder strap. The inertia reel is normally free but will lock if there is sudden movement as would occur in an accident.

A baggage compartment is located under each seat. Seat cushions hinge forward for access.

LANDING GEAR

A skid-type landing gear is used. Most hard landings will be absorbed elastically. However, in an extremely hard landing, the struts will hinge up and outward as the crosstube yields (becomes permanently bent) to absorb the impact. Slight crosstube yielding is acceptable. However, yielding which allows the tail skid to be within 34 inches (24 inches for R22 Standard or HP) of the ground when the helicopter is sitting empty on level pavement requires crosstube replacement.

Abrasion-resistant wear shoes are mounted on the bottom of the skids. These shoes should be inspected periodically, particularly if autorotation landings have been performed. Have skid shoes replaced whenever the thinnest point in the wear area is less than 0.05 inches (1.3 mm).

ROTOR BRAKE

If installed, the rotor brake is mounted on the aft end of the main gearbox and is actuated by a cable connected to a pull handle located above and behind the pilot's left shoulder. To stop the rotor, use the following procedure:

1. After pulling mixture off, wait at least 30 seconds.
2. Pull brake handle forward and down using moderate force (approximately 10 lb).
3. After rotor stops, it is recommended to use the rotor brake as a parking brake by hooking bead chain in slot in bracket.

The brake must be released before starting the engine. When the brake is engaged, the starter is disabled.

CAUTION

Applying rotor brake without waiting at least 30 seconds after engine stops or using a force which stops rotor in less than 20 seconds may damage brake shoes.

ENGINE PRIMER SYSTEM (OPTIONAL)

The primer is used to improve engine cold starting. The primer pump is located in front of the right seat near the hourmeter. Engine priming is performed as follows:

1. Unlock pump handle and pump as required for priming (normally two to three strokes). Pull handle up slowly to allow time for fuel to fill pump.
2. After priming, push handle full down and lock.

CARBON MONOXIDE DETECTOR

The carbon monoxide (CO) detector is installed if the optional cabin heater is installed. It indicates elevated cabin CO levels. CO is an odorless, toxic gas present in engine exhaust which causes headaches, drowsiness, and possible loss of consciousness. CO levels may become elevated due to an exhaust leak or exhaust recirculation during prolonged hovering.

The CO detector system consists of a sensor above the pilot's heater outlet and a caution light. A system check (light flashes twice) is performed each time power is switched on. A sensor malfunction is indicated by a continuing flash every four seconds.

If the caution light illuminates, shut off heater and open nose and door vents as required to ventilate the cabin. If hovering, land or transition to forward flight. If symptoms of CO poisoning (headache, drowsiness, dizziness) accompany caution light, land immediately. Have exhaust system inspected before next flight.

Many chemicals can damage the CO sensor. Avoid use of solvents, detergents, or aerosol sprays near the sensor. Temporarily tape off openings in top and bottom of sensor housing when cleaning cabin interior.

ADS-B EQUIPMENT

An Automatic Dependent Surveillance Broadcast (ADS-B) capable transponder is installed on later aircraft. The transponder transmits GPS position information to air traffic control to supplement radar/transponder information.

ADS-B "Out" capability is required for operation in certain airspace. ADS-B equipment installed at the factory meets the requirements of 14 CFR § 91.227. ADS-B Out operation is mostly automatic and requires little pilot action. Malfunctions will be annunciated on the transponder and/or GPS. Refer to transponder and GPS manufacturer's documentation for further details on ADS-B Out equipment operation.

NOTE

ADS-B Out equipment installed at the factory operates on frequency 1090 MHz. This frequency is also accepted for ADS-B Out equipment in most countries outside the United States.

NOTE

The ability to turn off ADS-B Out broadcasts is provided via transponder controls. However, ADS-B Out is required in certain airspace. ADS-B Out should not be selected off unless directed by air traffic control.

ADS-B equipment may also receive traffic information from other ADS-B equipped aircraft and (depending on specific equipment and country of operation) additional traffic and weather information from ground stations. ADS-B equipment that receives information is known as ADS-B "In", is not required by regulations, and is optional.

ADS-B In functionality requires a suitable display such as a moving map GPS or Multi-Function Display (MFD). ADS-B In equipment installed at the factory receives both approved US frequencies (978 MHz and 1090 MHz). Refer to avionics manufacturer's documentation for details on ADS-B In equipment operation.

EMERGENCY LOCATOR TRANSMITTER (OPTIONAL)

The Emergency Locator Transmitter (ELT) installation consists of a transmitter with internal battery pack, an external antenna, and a remote switch/annunciator. The transmitter is mounted to the upper steel tube frame and is accessible through the aft, upper cowl door. The remote switch/annunciator is located left of the cyclic stick.

The ELT is operated by a switch on the transmitter and a remote switch in the cockpit. The transmitter switch has been secured in the AUTO or ARM position at installation and should always be in this position for flight. The remote switch/annunciator is a three position switch with indicator light. This switch should also be in the AUTO or ARMED (middle) position for flight. With both switches set to AUTO/ARM, the ELT will begin transmitting when subjected to a high "G" load. When the unit is transmitting, the red indicator light illuminates.

Moving the remote switch to ON activates the transmitter. Use the ON position if an emergency landing is imminent and time permits.

If the ELT is inadvertently activated, use the RESET position of the remote switch to stop transmission and reset the unit. The red indicator will extinguish when unit is reset.

NOTE

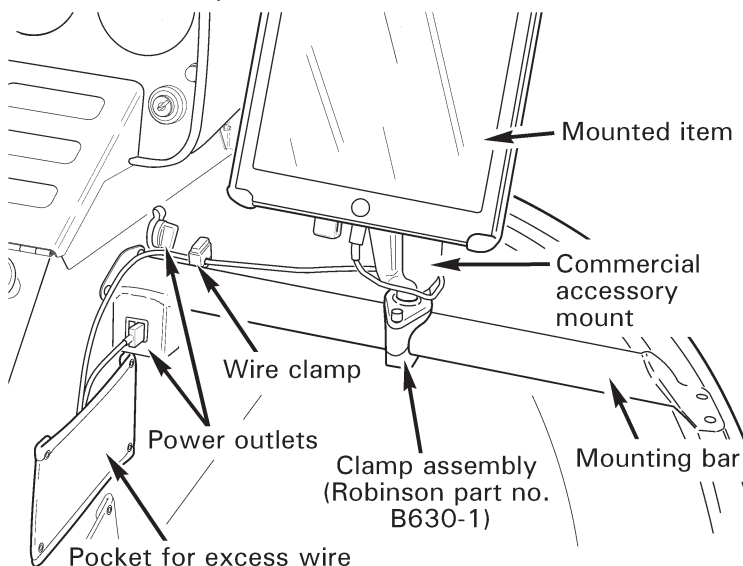
Earlier aircraft may have ELT installations without remote switch.

For more detailed instructions on ELT operation, maintenance, and required tests, refer to manufacturer's instructions supplied with the unit.

ACCESSORY MOUNTS (OPTIONAL)

Provisions for mounting small, portable items are an option. The provisions use mounting bars located forward of the pilot's seat, the copilot's seat, or both. The bars are fitted with one or more clamp assemblies which are compatible with a variety of commercially available accessory mounts. There is a 10 lb total weight limit for items attached to each bar. USB and cigarette-lighter-style power outlets are installed near the inboard end of the mounting bars. The power outlets are protected by the Aux Power circuit breaker and in-line fuses and are placarded with voltage/current ratings. Wire clamps and a pocket for securing excess wire are also provided.

The accessory mounts are intended to provide a safe means of mounting small items such as portable electronic devices. The mounting bar, clamp assembly, and power outlets are approved as part of the aircraft type design, but any items attached are the responsibility of the pilot in command under appropriate operating rules. Ensure that any items attached are secure and do not interfere with flight controls or primary field of view. Route any wires through the wire clamps or secure them to the bar with cable ties or tape.



COCKPIT CAMERA (OPTIONAL)

An optional video camera may be installed in the cabin ceiling. The camera records 4K video, intercom/comm audio, and GPS position both internally and to a removable flash drive inserted in the front of the camera housing. The internal memory retains only recent video and is not user accessible. Recording starts automatically when the helicopter battery is switched on and stops when it is started off.

Recording to the flash drive can be stopped or audio muted using the record and audio switches on the front of the camera housing. Do not remove the flash drive while a recording is in progress as this will corrupt the video file. To remove a flash drive when the helicopter battery switch is on, first stop the recording using the record switch.

A blue flashing light on the camera housing indicates video is being recorded to the flash drive. A green steady light indicates the camera is powered and operating normally. The green light will change to an amber flashing light if an internal camera fault is detected, in which case video may not be recorded.

Video recorded on the flash drive can be viewed on a Windows PC or Mac computer. Video is recorded in sequential 4 GB files with each file approximately 25 minutes in length. Video files are labeled HELICAM_XXXX.MP4, where XXXX is a sequential number. GPS position and altitude are optionally displayed in the video and are also recorded separately to files labeled HELICAM_XXXX.GPX. A 128 GB flash drive (as supplied with helicopter) will record approximately 10 hours of video. When full, the earliest video file is overwritten with the last recording.

NOTE

Flash drives must meet the criteria described in the *Cockpit Camera User Guide* in order to function reliably.

COCKPIT CAMERA (OPTIONAL) (cont'd)

The *Cockpit Camera User Guide* is available on the Robinson website, www.robinsonheli.com, and includes additional information on camera operation, playback options, and troubleshooting.