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**WARNING/CAUTION LIGHTS (cont'd)**

**LOW FUEL** Indicates approximately three gallons of usable fuel remaining. The engine will run out of fuel after ten minutes at cruise power.

***CAUTION***

Do not use **LOW FUEL** as a working indication of fuel quantity.

**AUX FUEL PUMP** Indicates low auxiliary fuel pump pressure. If no other indication of a problem, land as soon as practical. If light is accompanied by erratic engine operation, land immediately.

**FUEL FILTER** Indicates fuel strainer contamination. If no other indication of a problem, land as soon as practical. If light is accompanied by aux fuel pump warning light or erratic engine operation, land immediately.

**CLUTCH** Indicates clutch actuator circuit is on, either engaging or disengaging clutch. When switch is in the **ENGAGE** position, light stays on until belts are properly tensioned. Never take off before light goes out.

***NOTE***

Clutch light may come on momentarily during run-ups or during flight to retension belts as they warm-up and stretch slightly. This is normal. If, however, the light flickers or comes on in flight and does not go out within 10 seconds, pull **CLUTCH** circuit breaker and land as soon as practical. Reduce power and land immediately if there are other indications of drive system failure (be prepared to enter autorotation). Have drive system inspected for a possible malfunction.

**WARNING/CAUTION LIGHTS (cont'd)**

**ALT** Indicates low voltage and possible alternator failure. Turn off nonessential electrical equipment and switch ALT off then back on after one second to reset alternator control unit. If light stays on, land as soon as practical. Continued flight without functioning alternator can result in loss of power to tachometers, producing a hazardous flight condition.

**STARTER ON** Indicates starter motor is engaged. If light does not go out when starter button is released, immediately pull mixture off and turn battery switch off. Have starter motor serviced.

**LOW RPM** Indicates rotor speed below 97% RPM. To restore RPM, immediately lower collective, roll throttle on and, in forward flight, apply aft cyclic. Light is disabled when collective is full down.

**GOV OFF** Indicates engine RPM governor is switched off.

**CARBON MONOXIDE** Indicates elevated levels of carbon monoxide (CO) in cabin. Shut off heater and open nose and door vents. If hovering, land or transition to forward flight. If symptoms of CO poisoning (headache, drowsiness, dizziness) accompany light, land immediately.

**BRAKE** Indicates rotor brake is engaged. Release immediately in flight or before starting engine.

**FULL THROTTLE (if installed)** Indicates engine near full throttle. The governor will be ineffective because it cannot increase throttle to maintain RPM. Lower collective as required to extinguish light.

**HYD (if installed)** Indicates hydraulic system is switched off.

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

**2. Main Rotor (cont'd)**

- 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
- Upper forward cowl doors . . . . . Latched

**3. Lower Cowl Door – Right Side**

- Air box and duct . . . . . Secure
- Engine sheet metal . . . . . No cracks
- Fuel lines . . . . . No leaks
- Oil lines . . . . . No leaks or chafing
- Exhaust system . . . . . No cracks
- Throttle linkage . . . . . Operable
- Cowl door . . . . . Latched

**4. Aft Cowl Door – Right Side**

- Oil cooler door . . . . . 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
- Sheave condition . . . . . Check
- Flex coupling . . . . . No cracks, nuts secure
- Yoke flanges . . . . . No cracks
- Steel tube frame . . . . . No cracks
- Tail rotor control . . . . . No interference
- Tailcone attachment bolts . . . . . Check
- Cowl door . . . . . Latched

**5. Engine Rear**

- Cooling fan nut . . . . . Pin in line with marks
- Cooling fan . . . . . No cracks
- Fan scroll . . . . . No cracks
- Tailpipe hanger . . . . . No cracks

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

6. Empennage

Tail surfaces . . . . . No cracks  
Fasteners . . . . . Secure  
Position light . . . . . Check  
Tail rotor guard . . . . . No cracks

7. 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

8. Tailcone

Skins . . . . . No cracks or dents  
Strobe light condition . . . . . Check  
Antenna . . . . . Check

9. Cowl Door – Left Side

Engine oil . . . . . 7-9 qts  
Oil filter . . . . . Secure, no leaks  
Battery and relay (if located here) . . . . . Secure  
Steel tube frame . . . . . No cracks  
Engine sheet metal . . . . . No cracks  
Exhaust system . . . . . No cracks  
Cowl door . . . . . Latched

10. Main Fuel Tank

Quantity . . . . . Check  
Filler cap . . . . . Tight  
Leakage . . . . . None

**ENGINE STARTING TIPS**

Prime 3 to 5 seconds after fuel pump caution light extinguishes. If engine does not fire after 5 to 7 seconds of cranking, repeat priming sequence and reattempt start. If engine fires momentarily but dies before or while moving mixture to rich, pull mixture off, engage starter, and push mixture slowly rich while cranking. If engine fails to start after three attempts, allow starter to cool ten minutes before next attempt.

With a hot engine, it may be helpful to cool fuel in lines by running fuel pump for 30 seconds with mixture OFF prior to beginning start procedure (hold key in prime position).

**STARTING ENGINE AND RUN-UP**

Throttle . . . . . Closed  
Battery, strobe switches . . . . . ON  
Area . . . . . Clear  
Mixture . . . . . Rich  
Ignition switch . . . . . Prime, then Both  
Mixture . . . . . Pull OFF  
Starter . . . . . Engage until engine fires  
Mixture . . . . . Move full rich  
Mixture guard . . . . . Installed  
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  
Annunciator panel test (if equipped) . . . . . All lights on  
Audio alert (if equipped) . . . . . Test  
Wait for clutch light out . . . . . Circuit breakers in  
Warm-up RPM . . . . . 60 to 70%  
Engine gages . . . . . Green  
Mag drop at 75% RPM . . . . . 7% max in 2 seconds  
Sprag clutch check . . . . . Needles split  
Doors (if installed) . . . . . Closed and latched  
Limit MAP chart . . . . . Check  
Cyclic/collective friction . . . . . OFF  
Hydraulic system . . . . . Check  
Governor On, increase throttle . . . . . RPM 101-102%  
Warning lights . . . . . Out  
Lift collective slightly, reduce RPM . . . . . Horn/Light at 97%

**STARTING ENGINE AND RUN-UP (cont'd)**

***CAUTION***

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

***CAUTION***

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

***NOTE***

For hydraulic system check, use small cyclic inputs. With hydraulics OFF, there should be approximately one half inch of freeplay before encountering control stiffness and feedback. With hydraulics ON, controls should be free with no feedback or uncommanded motion.

***NOTE***

Idle mixture and speed may require adjustment as conditions vary from sea level standard. Refer to R44 Maintenance Manual for idle adjustment procedure.



**SECTION 5  
PERFORMANCE**

**GENERAL**

IGE hover controllability has been substantiated in 17 knot wind from any direction up to 9800 feet (2990 meters) density altitude. Refer to hover performance charts for allowable gross weight.

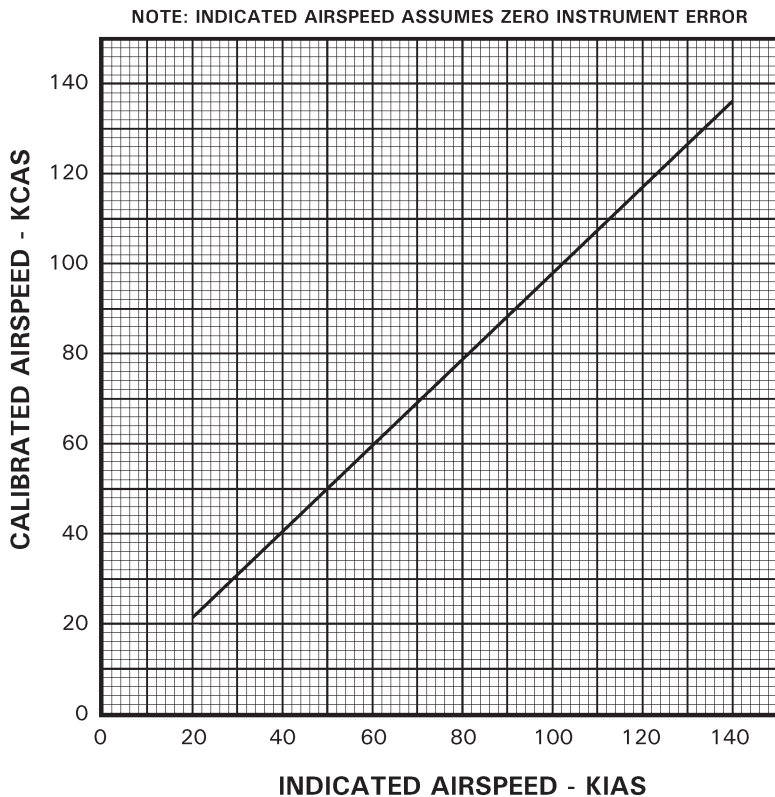
***CAUTION***

Performance data presented in this section was obtained under ideal conditions. Performance under other conditions may be substantially less.

Indicated airspeed (KIAS) shown on charts assumes zero instrument error.

**DEMONSTRATED OPERATING TEMPERATURE**

Satisfactory engine cooling has been demonstrated to an outside air temperature of 38°C (100°F) at sea level or 23°C (41°F) above ISA at altitude.



AIRSPEED CALIBRATION CURVE

**SECTION 7  
SYSTEMS DESCRIPTION  
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### **DRIVE SYSTEM (cont'd)**

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 IO-540 six-cylinder, horizontally-opposed, overhead-valve, air-cooled, fuel-injected engine with a wet sump oil system powers the helicopter. The engine is equipped with a starter, alternator, shielded ignition, two magnetos, muffler, two oil coolers, oil filter, and induction air filter. See Sections 1 and 2 for powerplant specifications and limitations.

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

Induction air enters through an opening on the right side of the fuselage and passes through the air filter within the air box. Air then passes along a flexible duct, through the fuel control, and into the engine. A spring-loaded door in the air box automatically opens to bypass the filter with engine compartment air should the filter or intake become blocked.

The pilot should adhere to recommended procedures 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 CONTROLS (cont'd)**

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 6000 feet (1800 meters), throttle-collective correlation and governor are less effective. Therefore, power changes should be slow and smooth.

***CAUTION***

At high power settings above 6000 feet (1800 meters), the throttle is frequently wide open and RPM must be controlled with collective.

Right-side tail rotor pedals are adjustable. To adjust, remove quick-release pin on each pedal by depressing button and pulling. Slide pedal fore or aft to most comfortable of three adjustment positions and reinstall quick-release pin. Verify pins are secure before flight.

Left-side pedals are not adjustable. However, optional pedals designed for shorter pilots (Robinson part nos. F755-9 and -10) may be installed in place of standard pedals.

### **FUEL SYSTEM (cont'd)**

Plunger-style drain valves are provided for the gascolator and for each fuel tank sump. The gascolator is located on the lower right side of the firewall and is drained by pushing up on the plastic tube which extends below the belly. Valves for both tanks are located inside the right cowl door below the auxiliary tank. Fuel samples are taken by extending the plastic tubes clear of the aircraft and pushing on the plungers. 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 28-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, under the left front seat, or beneath the instrument console.

The circuit breaker panel is on the ledge just forward of the left front 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.

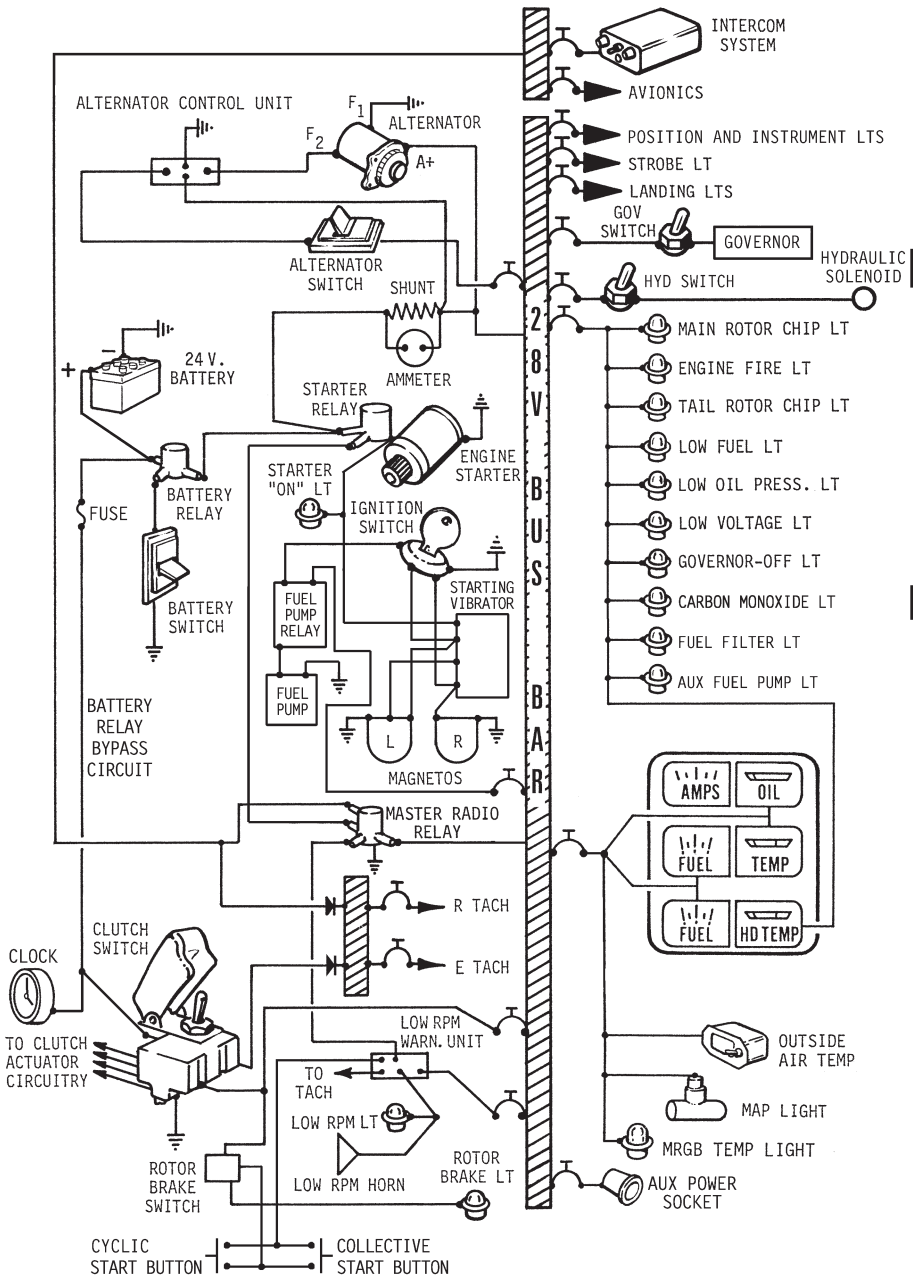
### ***NOTE***

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.

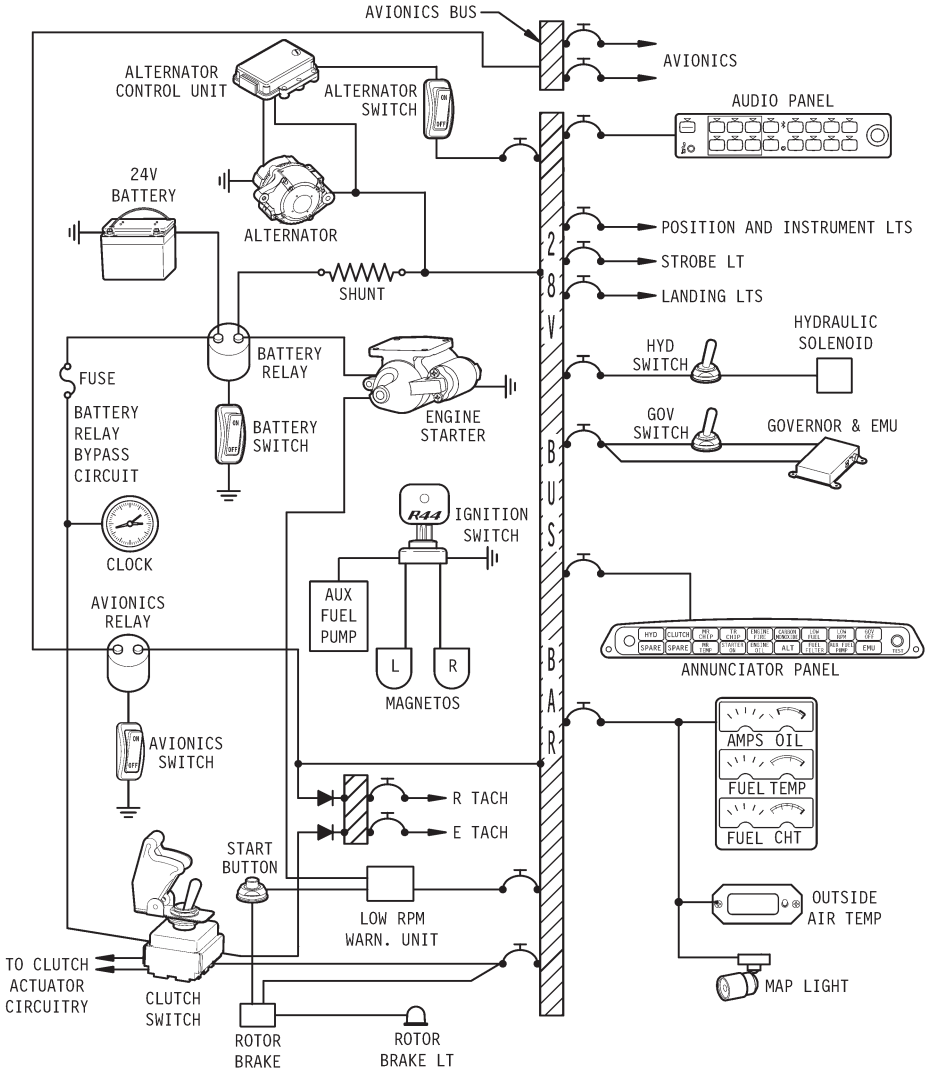


**ELECTRICAL SYSTEM**



**ELECTRICAL SYSTEM (EARLIER AIRCRAFT)**

ELECTRICAL SYSTEM (cont'd)



ELECTRICAL SYSTEM (LATER AIRCRAFT)

## **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 the EMU segment on the annunciator panel. The EMU segment will only illuminate while the annunciator panel test button is depressed. 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 annunciator means normal EMU operation. A slowly flashing indication (once every two seconds) or no illumination means there is a fault in the EMU's senders or circuitry. A fast flashing indication (four times per second) is given if 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. A rotating knob is provided to lock vents closed. 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 vent handle on the console face. Rotating the vent handle clockwise will lock its position. Air from the nose inlet is directed along the inside surface of the windshield for defogging as well as for ventilation.

The cabin heater consists of a muffler heat shroud, a control valve at the firewall, outlets forward of the tail rotor pedals and in the rear footwells, and interconnecting ducting. A heater control knob located to the left of the cyclic center post actuates the valve which directs heat either into the cabin or out an overboard discharge on the cabin underside.

### ***CAUTION***

In case of an in-flight engine fire, cabin heat should be turned off to seal cabin area from engine compartment.

## **SEATS, BELTS, AND BAGGAGE**

The seats are not adjustable but the pilot-side pedals are adjustable. Each helicopter is supplied with a cushion which can be placed behind the pilot to position him farther forward. This allows shorter pilots to reach the pedals, the cyclic grip in its most forward position, and controls on the center console.

Heated seat bottoms and backrests for the forward seats are an option. Switches to control low and high heat settings are located at the bottom of the avionics console. The seat heaters operate only when the alternator switch is in the ON position to reduce the likelihood of inadvertently draining the battery before the engine is started.

### **SEATS, BELTS, AND BAGGAGE (cont'd)**

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.

Four- or five-point harnesses are optional for the front seats. The lap belts on these harnesses should be adjusted to eliminate slack. On five-point harnesses, the lower strap should be adjusted as necessary to ensure that the buckle does not interfere with the cyclic in the full aft position. Later harnesses are equipped with a webbing stop located above the inertia reel. The stop limits shoulder strap retraction and should be adjusted so the straps are comfortable without excessive slack.

Optional anchor loops located in the cabin ceiling above the door posts provide attachment points for a safety tether for equipment or occupants during doors-off operation.

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 30 inches of the ground when the helicopter is sitting empty on level pavement requires crosstube replacement.

The four landing gear struts are fitted with aerodynamic fairings to reduce air drag. The helicopter is approved to fly with or without the fairings installed.

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).

### **LANDING GEAR (cont'd)**

Optional mirrors may be installed near the forward end of one or both landing gear skid tubes. Each mirror is mounted on a friction ball joint and may be adjusted to the desired angle.

### **ROTOR BRAKE**

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 on the cabin ceiling. 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 buttons are 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.

## **CARBON MONOXIDE DETECTOR**

The carbon monoxide (CO) detector 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.

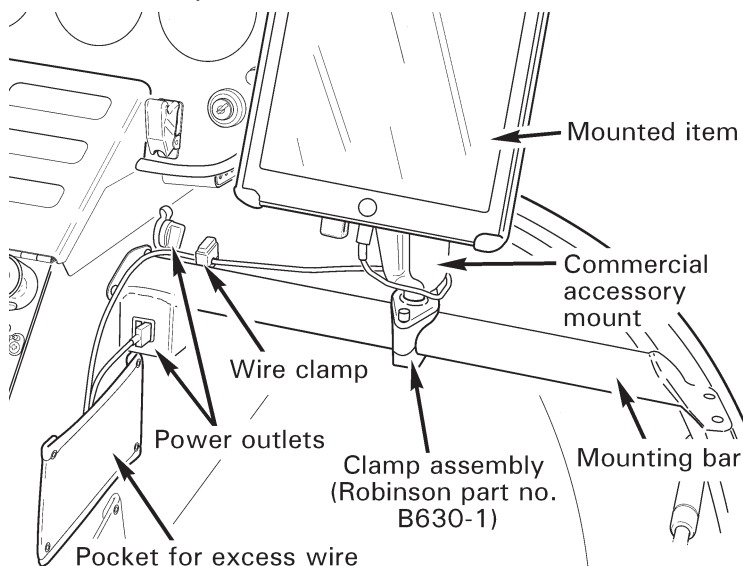
If the ELT is inadvertently activated, use the RESET position of the remote switch to stop transmission and reset the unit. The red indicator will extinguish when unit is reset.

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](http://www.robinsonheli.com), and includes additional information on camera operation, playback options, and troubleshooting.

### **CYCLIC GUARD (OPTIONAL)**

The optional cyclic guard is a bar that extends from the inboard corner of the left front seat to the instrument console. It is intended to act as a barrier to help prevent inadvertent interference with the cyclic control. The guard also provides a hand grip for a passenger's right hand.

In order to access the under seat compartment with the guard installed, pull the silver spring knob at the forward end of the guard and allow the aft end to rotate down away from the seat hinge. To re-secure the guard, lift the aft end and allow the spring knob to lock back in place.

It is recommended that the guard be installed whenever a non-pilot passenger occupies the left front seat. A pilot flying from the left seat may find that the guard contacts the right leg when feet are on the pedals. The guard should be removed prior to flight if the pilot finds it objectionable.

**SECTION 8  
HANDLING AND MAINTENANCE**

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**CLEANING HELICOPTER (cont'd)**

**CLEANING WINDSHIELD AND WINDOWS (cont'd)**

***CAUTION***

Do not use gasoline, other alcohols, benzene, carbon tetrachloride, thinner, acetone, or window (glass) cleaning sprays.

4. After cleaning plastic surfaces, apply a thin coat of hard polishing wax. Rub lightly with a soft cloth. Do not use a circular motion.

***CAUTION***

Windshield surface must be hydrophobic (water repellent) for good visibility in rain. When using a new cleaning or polishing product on windshield, verify water beads on surface before flying.

5. On acrylic windows (standard windshield), scratches can be removed by rubbing with jeweler's rouge followed by hand polishing with commercial plastic polish. Use a figure eight motion when polishing.

***NOTE***

Impact-resistant windshields are made from polycarbonate with a protective hardcoat and cannot be polished.

**CLEANING UPHOLSTERY AND SEATS**

1. Vacuum and brush, then wipe with damp cloth. Dry immediately.
2. Soiled upholstery, except leather, may be cleaned with a good upholstery cleaner suitable for the material. Follow manufacturer's instructions. Avoid soaking or harsh rubbing.

**CLEANING HELICOPTER (cont'd)**

**CLEANING UPHOLSTERY AND SEATS (cont'd)**

***CAUTION***

Avoid use of solvents, detergents, or aerosol sprays near CO sensor. Tape off openings in top and bottom of sensor housing when cleaning cabin interior.

3. Leather should be cleaned with saddle soap or a mild hard soap and water.

**CLEANING CARPETS**

Remove loose dirt with a whisk broom or vacuum. For soiled spots and stains, use nonflammable dry cleaning liquid.

**STORAGE**

The helicopter requires special preparation for long-term storage (greater than 30 days). Contact your maintenance provider to determine appropriate procedures prior to storage.



**SECTION 9  
SUPPLEMENTS**

**OPTIONAL EQUIPMENT SUPPLEMENTS**

Information contained in the following supplements applies only when the related equipment is installed.

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**NON-U.S. SUPPLEMENTS**

The following supplements contain additional information required by certain countries:

- Brazilian Supplement
- Canadian Supplement
- EASA Supplement
- FATA Supplement (Russia)
- IAC AR Supplement
- Indian Supplement
- Ukranian Supplement

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**FAA APPROVED  
R44, R44 II, R44 CADET  
PILOT'S OPERATING HANDBOOK**

**LITHIUM-ION BATTERY SUPPLEMENT**

This supplement must be included in the FAA-approved Pilot's Operating Handbook when the lithium-ion main battery is installed.

Information contained herein supplements or supersedes the basic manual only in those areas listed in this supplement. For limitations, procedures, and performance information not contained in this supplement, consult the basic Pilot's Operating Handbook.

APPROVED BY: **HIEN H TONG** Digitally signed by HIEN H TONG  
Date: 2020.12.10 13:39:02 -08'00'  
*for* Manager, West Flight Test Section, AIR-716  
Federal Aviation Administration  
Los Angeles, CA

DATE: 10 DEC 2020

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\* Manufacturer's data, not FAA approved.

**SECTION 1: GENERAL**

**INTRODUCTION**

This supplement contains changes and additional data applicable when the lithium-ion main battery is installed.

**SECTION 2: LIMITATIONS**

No change.

**SECTION 3: EMERGENCY PROCEDURES**

**WARNING/CAUTION LIGHTS**

**BATT FAULT** Indicates abnormal battery operation. Charging, discharging, or both may be disabled. Land as soon as practical. Alternator will continue to supply power in flight.

***NOTE***

Battery's internal circuitry may disable charge/discharge functions due to over-temperature, over/under voltage, or excessive current draw. A flashing light means the fault may be recoverable (battery will reset itself) either when the condition improves or during a power cycle at the next landing. A steady light means battery maintenance or replacement will likely be necessary.

**SECTION 4: NORMAL PROCEDURES**

**STARTING ENGINE AND RUN-UP**

After Battery switch ON, add:

Battery heater indicator light .....Extinguished

***NOTE***

The lithium-ion battery has a built-in heater. When the battery switch is ON, the BATT HEATER light illuminates during the heating cycle and extinguishes when the battery is warm enough to attempt a start. The indicator light is disabled after engine start, but the heater will continue to cycle as required to maintain optimum battery temperature.

**SECTION 5: PERFORMANCE**

No change.

**SECTION 6: WEIGHT AND BALANCE**

No change.

## **SECTION 7: SYSTEMS DESCRIPTION**

### **ELECTRICAL SYSTEM**

A 17 amp-hour lithium-ion battery replaces the standard 24-volt lead-acid main battery. The lithium-ion battery includes built-in circuitry that monitors temperature, voltage, and current draw and manages battery charge and discharge. The circuitry automatically disables charge and/or discharge if any electrical or thermal problems are detected. The circuitry will also interrupt power if a start is attempted with insufficient charge to prevent permanent battery damage. The battery uses lithium-iron-phosphate chemistry which is less susceptible to thermal runaway than some other lithium battery chemistries.

The metal battery case is designed to contain any heat or gases generated within the battery and is vented overboard. No venting should occur during normal operation.

Two annunciator panel segments, BATT FAULT and BATT HEATER, show battery status. The annunciator panel test button should cause these segments to illuminate along with the rest of the annunciator panel. The segments will also illuminate briefly when the battery switch is turned on after several hours of inactivity.

BATT FAULT illuminates if the battery has an over- or under-voltage condition, an over-temperature condition, or if current draw exceeds limits. A flashing light indicates a recoverable fault. The light may go out if the fault corrects itself (e.g. temperature decrease) or may go out as a result of a power cycle at the next landing. A steady light indicates battery maintenance or replacement may be required. The emergency procedure for a fault light (flashing or steady) is to land as soon as practical. The alternator will continue to supply electrical power during the landing.

**SECTION 7: SYSTEMS DESCRIPTION (cont'd)**

**ELECTRICAL SYSTEM (cont'd)**

The battery incorporates an internal heater for cold weather operation. The heater attempts to maintain a battery temperature of at least 50°F (10°C). When the battery is switched ON, BATT HEATER illuminates while the heater is warming the battery and extinguishes when the battery is warm enough to attempt an engine start. On very cold days, the heating cycle may take 10 minutes or more. The heater light is disabled while the engine is running but the heater will continue to function as long as the battery switch is ON.

**SECTION 8: HANDLING AND MAINTENANCE**

Nominal charging voltage for the lithium-ion battery is 28.8 volts. Some lead-acid chargers may not provide enough voltage to fully charge the battery. Ensure charging equipment is compatible with lithium-ion batteries.

Refer to the R44 Maintenance Manual for additional handling and maintenance instructions.

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**PILOT KNOWLEDGE AND PROFICIENCY (cont'd)**

- Flight planning (*Ref SNs 15, 26, and 43*)
  - Thorough preflight inspection
  - Fuel
  - Weather
  - Performance (hot/high/loading)
- Distractions (*Ref SNs 16, 34, 36, and 41*)
  - Failure to keep eyes outside scanning for wires, other obstacles, and traffic
  - High workload missions such as photo flights
  - Passengers
  - Avionics
  - Cell phones
- Low-G and mast bumping (*Ref SNs 11, 29, and 32*)
  - Avoidance
    - Reduce airspeed in turbulence
    - Monitor airspeed when lightly loaded
    - Ensure passenger controls are removed
  - Recognition and recovery

**CAUTION**

Never practice/demonstrate low-G in flight. Low-G training should be knowledge based only.

- Low RPM considerations (*Ref SNs 10, 24, and 29*)
  - Recognition and recovery
- Power failures (*Ref SNs 10, 24, and 29*)
  - Instinctive autorotation entry
  - Continuously consider emergency landing sites throughout every flight
- Practice autorotations (*Ref SN 38*)
  - Proven, safe methods

**CAUTION**

In-flight practice of Low RPM, power failures, and autorotations should only be conducted under the supervision of an instructor.

- Confined area operations (*Ref SN 22*)
  - High and low reconnaissance
  - Assessing wind
  - Power margins

**SAFETY NOTICES**

The following Safety Notices have been issued by Robinson Helicopter Company as a result of various accidents and incidents. Studying the mistakes made by other pilots will help you avoid making the same errors. Safety Notices are available on the RHC website: [www.robinsonheli.com](http://www.robinsonheli.com).

**SAFETY  
NOTICE**

**TITLE**

- SN-1 Inadvertent Actuation of Mixture Control in Flight
- SN-9 Many Accidents Involve Dynamic Rollover
- SN-10 Fatal Accidents Caused by Low RPM Rotor Stall
- SN-11 Low-G Pushovers - Extremely Dangerous
- SN-13 Do Not Attach Items to the Skids
- SN-15 Fuel Exhaustion Can Be Fatal
- SN-16 Power Lines Are Deadly
- SN-17 Never Exit Helicopter with Engine Running  
Hold Controls When Boarding Passengers  
Never Land in Tall Dry Grass
- SN-18 Loss of Visibility Can Be Fatal  
Overconfidence Prevails in Accidents
- SN-19 Flying Low Over Water is Very Hazardous
- SN-20 Beware of Demonstration or Initial Training Flights
- SN-22 Vortex Ring State Catches Many Pilots By Surprise
- SN-23 Walking into Tail Rotor Can Be Fatal
- SN-24 Low RPM Rotor Stall Can Be Fatal
- SN-25 Carburetor Ice
- SN-26 Night Flight Plus Bad Weather Can Be Deadly
- SN-27 Surprise Throttle Chops Can Be Deadly
- SN-28 Listen for Impending Bearing Failure  
Clutch Light Warning
- SN-29 Airplane Pilots High Risk When Flying Helicopters
- SN-30 Loose Objects Can Be Fatal
- SN-31 Governor Can Mask Carb Ice
- SN-32 High Winds or Turbulence
- SN-33 Drive Belt Slack
- SN-34 Aerial Survey and Photo Flights - Very High Risk
- SN-35 Flying Near Broadcast Towers
- SN-36 Overspeeds During Liftoff
- SN-37 Exceeding Approved Limitations Can Be Fatal
- SN-38 Practice Autorotations Cause Many Training Accidents
- SN-39 Unusual Vibration Can Indicate a Main Rotor Blade Crack
- SN-40 Post-Crash Fires
- SN-41 Pilot Distractions
- SN-42 Unanticipated Yaw
- SN-43 Use Extra Caution During Post-Maintenance Flights
- SN-44 Carrying Passengers

## **Safety Notice SN-30**

Issued: Jun 94 Rev: Apr 2009

### LOOSE OBJECTS CAN BE FATAL

Fatal accidents have occurred due to loose objects flying out of the cabin and striking the tail rotor. Any object striking the tail rotor can cause failure of a tail rotor blade. Loss of or damage to a tail rotor blade may cause a severe out-of-balance condition which can separate the tail rotor gearbox or entire tail assembly from the tailcone, resulting in a catastrophic accident. Accidents have also been caused by fuel caps, birds, and other objects striking the tail rotor. Before each flight perform the following:

- 1) Walk completely around the aircraft checking fuel cap security and tail rotor condition. Ensure no loose objects or debris in helicopter vicinity. Verify cotter rings or pins are installed in all door hinge pins.
- 2) Stow or secure all loose objects in the cabin. Even with doors on, items such as charts can be sucked out of a vent door.
- 3) Instruct passengers regarding the dangers of objects striking the tail rotor. Warn them never to throw anything from the helicopter or place items near vent doors where they could get sucked out.
- 4) Firmly latch all doors.
- 5) Never fly with a left door removed. (Remove only the right door for ventilation.)

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## **Safety Notice SN-31**

Issued: Dec 96

### GOVERNOR CAN MASK CARB ICE

With throttle governor on, carb ice will not become apparent as a loss of either RPM or manifold pressure. The governor will automatically adjust throttle to maintain constant RPM which will also result in constant manifold pressure. When in doubt, apply carb heat as required to keep CAT out of yellow arc during hover, climb, or cruise, and apply full carb heat when manifold pressure is below 18 inches.

Also remember, if carb heat assist is used it will reduce carb heat when you lift off to a hover and the control may require readjustment in flight.

## **Safety Notice SN-32**

Issued: Mar 1998

Revised: June 2020

### HIGH WINDS OR TURBULENCE

Flying in high winds or turbulence should be avoided.

A pilot's improper application of control inputs in response to turbulence can increase the likelihood of a mast bumping accident. If turbulence is encountered, the following procedures are recommended:

1. Reduce power and use a slower than normal cruise speed. Mast bumping is less likely at lower airspeeds.
2. For significant\* turbulence, reduce airspeed to 60–70 knots.
3. Tighten seat belt and rest right forearm on right leg to minimize unintentional control inputs. Some pilots may choose to apply a small amount of cyclic friction to further minimize unintentional inputs.
4. Do not overcontrol. Allow aircraft to go with the turbulence, then restore level flight with smooth, gentle control inputs. Momentary airspeed, heading, altitude, and RPM excursions are to be expected.
5. Avoid flying on the downwind side of hills, ridges, or tall buildings where turbulence will likely be most severe.

The helicopter is more susceptible to turbulence at light weight. Reduce speed and use caution when flying solo or lightly loaded.

\*What is considered significant turbulence will depend on pilot experience and comfort level.

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## **Safety Notice SN-33**

Issued: March 1998

Revised: July 2013; July 2021

### DRIVE BELT SLACK

Pilots must ensure R22 and R44 drive belts do not have excessive slack during engine start. Belts that are too loose may jump out of their sheave grooves while being tensioned, but the pilot has no way of observing this. Therefore, the following checklist items are very important.

1. Per preflight checklist, with clutch disengaged, deflect belts inboard just above fan scroll on aircraft right side. Verify a maximum of 1.5 inches (4 cm) deflection. If belts deflect further, have belt tension actuator adjusted prior to flight.
2. Per run-up checklist, verify rotor turns within 5 seconds after engaging clutch switch. If time is longer, shut down and have belt tension actuator adjusted prior to flight.

## **Safety Notice SN-41**

Issued: May 2013      Revised: July 2021

### PILOT DISTRACTIONS

Pilot distractions from mobile phones have been the cause of several recent fatal accidents.

Modern avionics and personal electronic devices, in particular mobile phones, can easily divert the pilot's attention from the primary duty of controlling the helicopter. Reading charts and attending to passengers are other common distractions.

During flight, be conscious of distractions and vigilant about keeping eyes focused outside as much as possible. Any avionics programming that takes more than a few seconds should be done while on the ground. Mobile phones should be carried in case of an unscheduled or emergency landing but should never be used by the pilot during flight.

When hovering, keep both hands on the controls. If tuning a radio or other task is required, first land and reduce collective pitch. When dealing with distractions in forward flight, reduce power, slow down, and frequently look outside to verify straight and level flight.

Occasionally, pilots neglect to latch a door before taking off. Never attempt to latch a door while hovering or in flight. It is safer to land before closing a door.

## **Safety Notice SN-42**

Issued: May 2013 Rev: Jul 2019

### UNANTICIPATED YAW

A pilot's failure to apply proper pedal inputs in response to strong or gusty winds during hover or low-speed flight may result in an unanticipated yaw. Some pilots mistakenly attribute this yaw to loss of tail rotor effectiveness (LTE), implying that the tail rotor stalled or was unable to provide adequate thrust. Tail rotors on Robinson helicopters are designed to have more authority than many other helicopters and are unlikely to experience LTE.

To avoid unanticipated yaw, pilots should be aware of conditions (a left crosswind, for example) that may require large or rapid pedal inputs. Practicing slow, steady-rate hovering pedal turns will help maintain proficiency in controlling yaw. Hover training with a qualified instructor in varying wind conditions may also be helpful.

Note that thrust of any tail rotor decreases significantly as RPM decreases. Low RPM combined with high torque, as occurs when over-pitching, may result in an uncontrollable right yaw (see also Safety Notice SN-34).

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## **Safety Notice SN-43**

Issued: January 2015

### USE EXTRA CAUTION DURING POST-MAINTENANCE FLIGHTS

A number of fatal accidents have occurred during flights immediately following maintenance. In several cases, the cause was incorrect or incomplete reassembly of the helicopter, and the error would have been detectable during a careful preflight inspection.

Even the best maintenance personnel can become distracted and make a mistake. Pilots should conduct an especially thorough preflight inspection after maintenance has been performed. If possible, speak to the technicians who performed the work, find out exactly what was done, and pay special attention to those areas. Professional maintenance personnel will appreciate the pilot's commitment to safety and will welcome an additional check of their work.

Any work done on the flight control system deserves special attention because a flight control disconnect is almost always catastrophic. During track and balance work, always climb up to the rotor head for a close inspection of the pitch link and control tube fasteners after each adjustment. Never rush or skip preflight steps.