

Section 26

Inspection of a New Aircraft

Procedures covered in this section:

Post-construction checklist; pre-flight briefing notes; dynamic test; tie down procedures; instruments; fuel tank dip hose; amateur built aircraft checklist.

Cards used in this section:

None

Prints used in this section:

Review all prints.

Templates used in this section:

None

Tools required for this section:

Adjustable wrench 10"	Mallet	Ruler	Torque wrench
Allen wrenches	Pliers	Screwdrivers	Tracking stick
Drift punch	Protractor level	Spring Scale	
Level	Rope	Tape Measure	

Ratchet with sockets of the following sizes: 1/4", 5/16", 3/8", 7/16", 1/2", 9/16", 11/16", 3/4", 7/8"

Wrenches of the following sizes: 1/4", 5/16", 3/8", 7/16", 1/2", 9/16", 11/16", 3/4", 7/8"

Notes:

The following inspection checklist is required to meet the FARS and keep the aircraft's airworthiness certificate valid.

POST-CONSTRUCTION CHECKLIST

- _____ Remove the covers that are held in place with Dzus buttons and nut plates.
- _____ Using a set of wrenches, check the security and length of all bolts.
- _____ Check the safety wire on the tail boom support brace attachment bolts.
- _____ Check the safety wire on the cyclic control attachment bolts.
- _____ Check the safety wire on the collective control attachment bolts.
- _____ Check the safety wire on the anti-torque pedal control attachment bolts.
- _____ Check the safety wire on the tail rotor rod end attachment bolts on the pitch horns and slider.
- _____ Check the safety wire on the tail rotor pitch actuator arm pivot casting.
- _____ Check the safety wire on the radiator mounting bolts.
- _____ Check the safety wire on the three bolts holding the sprocket hub to the main rotor shaft (BOTH ENDS OF THE BOLTS).
- _____ Check the safety wire on the four bolts holding the main sprocket to the sprocket hub (BOTH ENDS OF THE BOLTS).
- _____ Check safety wire on gearbox (front and rear) roll pin/shaft.
- _____ Check safety on oil drain for rear gear box.
- _____ Check safety wire on screws to clutch spring tube weldment.
- _____ Check that the cyclic control attachment bolts are Loctited.
- _____ Check that the collective control attachment bolts are Loctited.
- _____ Check that the anti-torque pedal control attachment bolts are Loctited.
- _____ Check that the 1/2" nut on the clutch idler pulley is Loctited.
- _____ Check that the bolts on the top and bottom of the clutch idler pulley assembly are Loctited.
- _____ Check that the lower main shaft bearing is Loctited to the shaft.
- _____ Check that the lower secondary shaft bearing is Loctited to the shaft.
- _____ Check that the pulleys and the bearings are Loctited to the fan drive countershaft.
- _____ Check that the fan drive bearing is Loctited to the secondary shaft and that the two set screws are tight.
- _____ Check that the tail rotor shaft bearings are Loctited to the shaft.
- _____ Check that the tail rotor counter weight bolts are Loctited. _____ Check tightness of the nuts on the fuel tank strainer fittings (7-10 ft. lbs.).

POST-CONSTRUCTION CHECKLIST CONT'D.

- _____ Check the travel of the tail rotor cable at the pedal location.
Spec: 2-3/4" to 3" Actual: _____".
- _____ Check the angle of the tail rotor blades at each end of travel.
Spec: 8 degrees negative, 24 degrees positive. Actual: _____ degrees negative _____ degrees positive.
- _____ Check the degrees of travel of the cyclic control.
Spec: 52 degrees fore/aft and lateral from stop to stop. Actual: _____ degrees fore/aft _____ degrees lateral.
- _____ Check the bias adjustment of the cyclic control cables.
Spec: 1-2 lbs. pull to align the rod end with the slot in casting. Actual: _____
- _____ Check the travel of the swash plate and the angle of the swash plate in reference to the main rotor shaft.
Spec: 5 to 5-1/2 degrees fore; 5 to 5-1/2 degrees aft; 5 to 5-1/2 degrees left; 5 to 5-1/2 degrees right.
Actual: _____ degrees fore _____ degrees aft _____ degrees left _____ degrees right.
- _____ Check the travel of the collective control.
Spec: bottom of the pocket when full down; making contact with the mounting bracket when full up.
- _____ Check the angle of the main rotor blades.
Spec: 1-1/2 to 2 degrees negative; 9-1/2 degrees positive.
Actual: _____ degrees negative _____ degrees positive.
- _____ Check the total teeter travel of the rotor hub.
Spec: 7-1/4 degrees each way from the main rotor shaft.
Actual: _____ degrees fore _____ degrees aft.
- _____ Check for no interference between the cyclic and collective when they are at each end of travel.
- _____ Check the alignment of the engine pulley and secondary pulley.
- _____ Check the freedom of the clutch idler pulley assembly.
- _____ Check the tension of the main drive belts in the disengaged position.
Spec: 7 lbs. pull moves the belt 1/2". Actual: _____ lbs. pull moves the belt _____".
- _____ Check the alignment of the fan drive belts.
- _____ Check the alignment of the alternator drive belt.

POST-CONSTRUCTION CHECKLIST CONT'D.

_____ Check the tension of the tail rotor drive belt.

Spec: 7 lbs. on tension tool with 1/2" movement.

Actual: _____ lbs. on tool with _____ " movement.

_____ Check the routing and security of all water and oil lines.

_____ Check the routing and security of all electrical wires.

_____ Check the security and clearance of all heat shielding.

_____ Check the rocker clearance in the engine.

Spec: .004" -.006" when cold on both intake and exhaust. Actual: _____".

_____ Check the angle of the horizontal trim fin.

Spec: the chord line of the fin is parallel to top of tail boom.

Actual: _____ degrees in reference to top of tail boom.

_____ Check the angle of the vertical trim fin.

Spec: the chord line of the fin aligns with a point 15-1/2" to the pilot side of the main rotor shaft.

Actual: _____ " from the _____ side of the shaft.

_____ Check the distance between the #1 tail boom bulkhead and the rear square drive tube.

Spec: 23". Actual: _____".

PRE-FLIGHT BRIEFING NOTES

WARNING: When the starter is engaged, all drive train components will turn, including the main rotor blades if they are installed.

Safety:

1. Only essential personnel should be around the helicopter when the rotor is turning.
2. When approaching the helicopter in operation, always approach from the front quadrant in view of the pilot and be sure the pilot is aware of your approach before getting close to the boundary agreed upon.
3. Be aware of the tail rotor dangers when moving around the helicopter for inspections and other tasks.
4. The pilot should be sure that all personnel are clear of the helicopter before proceeding to the next maneuver and if any danger exists.
5. The pilot and ground personnel should expect a problem when the engine is started the first time (leak in the water, oil, or fuel lines, noise that is not normal, etc.) and have a plan to control the situation.
6. The component must respond correctly when input from the control is applied.
7. New belts will stretch the moment they are in use, therefore we recommend the following as a guide:
 - A. Install new drive belts and adjust to the correct tension.
 - B. If this is a new helicopter, start the engine and do all of the tests listed on the next page. **Check belt tension every time the engine is stopped**, and readjust if necessary to achieve the correct tension. If a belt becomes loose enough to slip, it will get hot and destroy the cord inside the belt. When the cord is damaged and the belt is cold, the belt will work satisfactorily until it gets warm, and at that point it will stretch and slip enough to cause a malfunction, resulting in loss of power to the drive train (both main drive and tail rotor drive).
 - C. Normal times to check and adjust the main drive belt tension:
 - Before every engine start.
 - At installation of new belt.
 - At 15 minutes after installation of new belt.
 - At 30 minutes after installation of new belt.
 - At 45 minutes after installation of new belt.
 - At 1 hour after installation of new belt.
 - At 2 hours after installation of new belt.
 - At 10 hours after installation of new belt.
 - Normally after 10 hours, the main drive belts stabilize and only need to be kept clean.
 - D. Normal times to check and adjust the tail rotor belt tension:
 - At installation of new belt.
 - After installation, every 15 minutes that the engine is running (idle or operating RPM) until no further adjustment is required.
 - At every pre-flight inspection.
 - At every post-flight inspection.

NOTE: Belts that have run hot or have been covered with oil should be replaced.

DYNAMIC TEST

The dynamic test cannot be done until all the items covered in the static condition have been checked off. The purpose of doing the dynamic test is to prove that the helicopter will perform and react as stated in the manuals. You should be prepared for everything to go wrong when doing these tests and if it does, you will react quickly and correctly.

- _____ Select a test area that will allow the square drive tubes to be level laterally and 3 degrees forward.
- _____ Secure the helicopter to the ground as per the drawing (see next page).
- _____ Check the records of the hang test to ensure that the main rotor shaft angles are within the allowable limits (see Flight Manual).
- _____ Work out the weight and balance to have center of gravity in the middle of the chart for the first flight test (see Flight Manual).

First start up:

Oil pressure in _____ seconds _____ PSI

Idle RPM: _____ rotor _____ engine

Water pump primed? yes/no _____

Number of times had to bleed the pump to achieve a good prime: _____

Any noise in the drive train that was not expected? yes/no _____

Any feedback in the controls? yes/no cyclic _____ pedals _____ collective _____

Any leaks? yes/no water _____ oil _____ gas _____

Stable temperature? water _____ oil _____ minutes to achieve _____

Track on the main rotor blades are within _____ inches

Do all the instruments work? yes/no _____

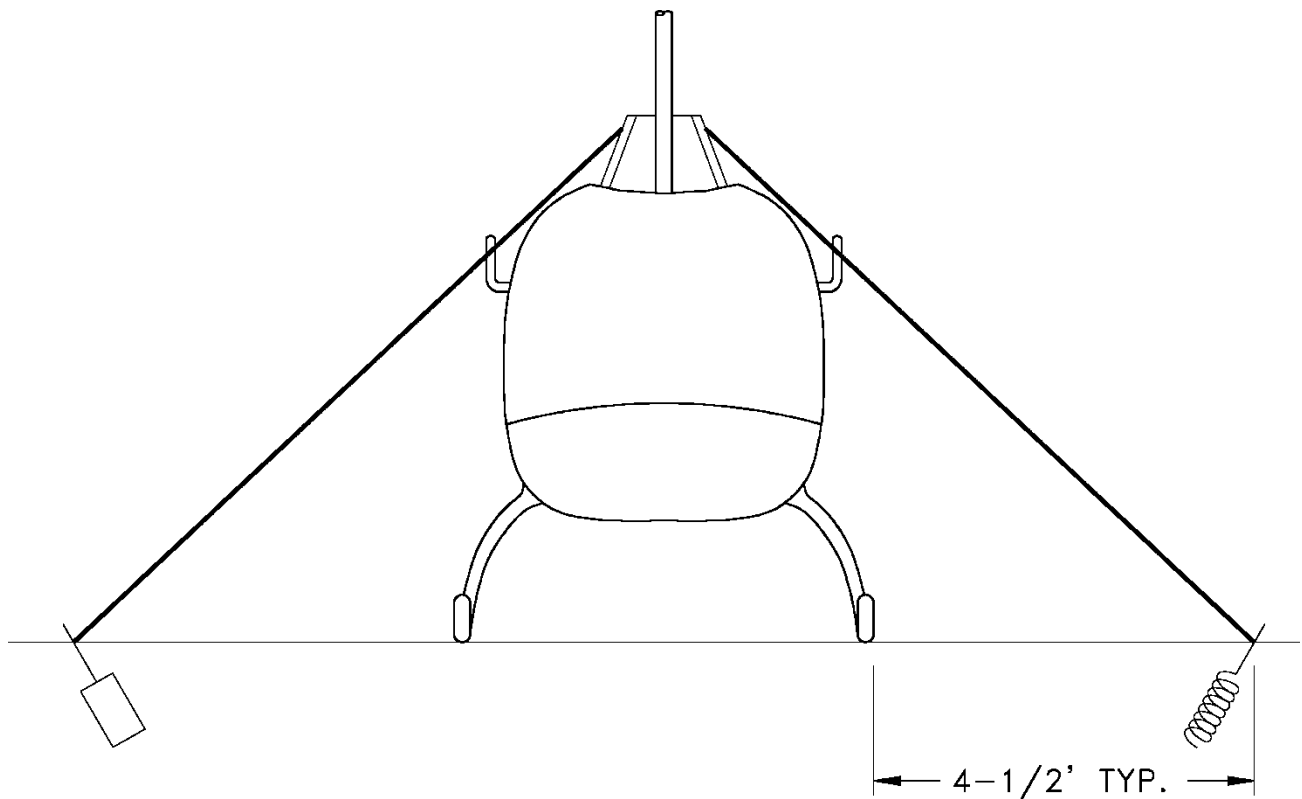
Do the controls respond correctly? yes/no cyclic _____ pedal _____ collective _____ throttle _____

Timing check on number one ign. _____ number two ign. _____

List the procedure used to obtain the best starting results:

TIE DOWN PROCEDURES FOR FIRST RUN-UPS

1. Remove doghouse.
2. Fasten 3/8" (or heavier) Nylon rope to hood bracket through lightening holes.
3. Use a firm, deeply buried anchor that will withstand 700 to 800 pounds of pull (dead man or long spiral anchor).
4. Allow very little slack in the tie down ropes for first run-ups. Later use no more than 6 to 9 inches of slack.
5. The tie down ropes are to insure that all controls are installed correctly and that the weight and balance is within limits.
6. **DO NOT ATTEMPT TO HOVER WITH THE ROPES ATTACHED.**



INSTRUMENTS

1. Self-Calibrating Dual Engine/Rotor Tach

Before installing the tach, perform the following test to confirm that the unit is working properly and was not damaged in transit. Use a known good 12V battery, or a regulated +12V DC power supply. **DO NOT USE A BATTERY CHARGER.** (A new 9V "transistor radio" type battery can also be used for this test.)

Connect +12V to pin 4. Connect GND to pin 3. (Ensure polarity is correct, reverse polarity may damage the tach.) Leave all other pins unconnected. The tach should go through its self test routine. Both meters will go to 100%, and both LEDs will flash, for 4 seconds. If the tach responds in this way then it is functioning correctly. If either of the needles do not read very close to 100% (i.e. between 98% - 102%), or if they go to different positions, then it is likely that the meter may have been damaged. If this is the case then it should be returned for repair. Do not try to re-calibrate the gauge using the trim pots.

Also, check the "rest" position of both needles when the tach does not have power connected to it. The needles should sit close to the first division (45%) on the scale, or very slightly below the first division. The rest position of the needles should not vary more than plus or minus one division.

Note that the tach has been calibrated with the gauge positioned upright, and a few degrees back, as it would be when normally installed in the instrument panel. It should be tested in this position. If horizontal, upside down, or in any other position, it may give an incorrect reading.

Pin #1 on the back of the gauge is for an optional piezo sounder that will pulse slow for low rotor RPM and fast for high rotor RPM. Use a Kingstate KPE-650SA or similar, recommended 200 Ma Max. Connect pin #1 to ground side of relay to control a load heavier than 200 milliamps. Connect the other side of relay to power source.

When the instrument is first switched on, the tach will perform a self test. Both pointers will go to 100%, both LED's will flash, and the sounder will activate twice. (If a microswitch for the sounder is installed on the collective, then the sounder should not operate if the collective is fully down in the pocket.)

The low rotor speed warning will operate between 70% and 92% rotor RPM. The high rotor speed warning will operate above 108% rotor RPM.

Note: The low rotor RPM detection audible alarm function is deactivated when the instrument is first switched on each time. This function becomes operational only after the rotor speed has been raised above 94% for the first time after start-up.

If rotor tach reads erratic, adjust sender closer to magnets.

NOTE: If the engine RPM needle rises above the green arc when the aircraft is in the light position or hovering, it is an indication that the belts are slipping. The engine should not be operated in this condition, as damage could occur to the drive belts and pulleys.

2. Fuel Gauge/Sender Calibration

CAUTION: Before connecting or disconnecting wires to the gauge or sender, make sure the battery is disconnected.

NOTE: Calibration should be performed with the gauge and all wiring installed in the aircraft.

Do not use a battery charger for calibration or operation.

It is recommended that you use a tube or tank of fuel the same depth as your fuel tank for calibration, as this procedure requires you to remove the probe from the tank several times.

Be sure the unit is dry before you attempt to calibrate. Residual fuel left inside the probe will give erroneous readings and affect the calibration. If your unit has been immersed in fuel, let it dry before you calibrate.

The empty and full adjustment screws are located on top of the sending unit. A small slotted screwdriver is required to make the adjustments. Turn both the empty and full adjustments to the full CW (clockwise) position, then connect the wires.

Slowly turn the empty screw CCW (counter clockwise) until the needle on the gauge goes to the empty mark. The needle should be on or just below the empty mark. Turn the screw CW to make sure the needle starts to move up the scale immediately, then turn CCW until the needle returns to the empty mark. This is the empty reference mark. Repeat this step until you are sure the empty reference is obtained.

Put the probe completely into the fuel. Turn the full screw CCW until the needle indicates the fuel level in your container. For best results, the probe should be completely immersed in the fuel. If you accidentally adjust below your actual tank level, turn the full screw to the full CW position, then CCW to indicate tank level.

Remove the probe from the fuel. The needle should go to the empty mark or just above. Shake the probe a few times to remove the residual fuel. The needle should now rest on the empty mark.

4. Fuel Gauge Low Level Warning Light

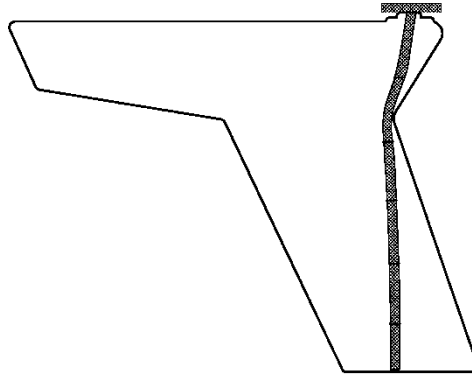
The fuel gauge is set at the factory for the low level warning light to come on when the needle reaches 1/8 on the gauge. An "adjustment set" is supplied with the gauge and can be used to change the set point of the warning light. To do this, disconnect all wires from the fuel gauge. Attach the adjustment set wires to the gauge as follows:

Green wire to #2, Red wire to #4, Black wire to #5

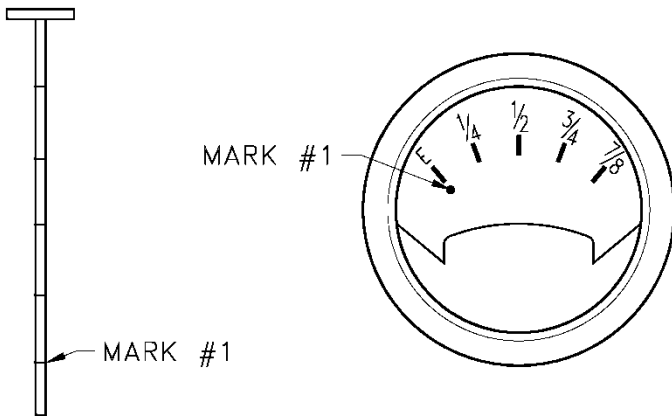
Attach a 9-volt battery to the adjustment set. Turn the thumb wheel on the adjustment set to the reading at which you want the light to come on. Using a small screwdriver, turn the adjustment screw on top of the gauge to adjust the light so that it just comes on. By rotating the thumb wheel you may recheck the "on" point. Remove the adjustment set and re-attach the wires to the gauge.

FUEL TANK DIP HOSE

Make a fuel tank dip hose as shown below from a piece of 1/2" fuel hose. The dip hose should be used before each flight to verify the amount of fuel remaining in the tanks. If the dip hose is curved, the inside of the curve must always go towards the front of the tank.



To calibrate the dip hose, start with empty fuel tanks and add a measured amount of fuel. (Any unit of measure may be used. Gallons are used here as an example.) Dip the hose all the way into the tank, up to the "T" handle. Withdraw the hose and mark the fuel level. Make the mark permanent by inserting a piece of safety wire through the hose at that point, then wrap the wire around the hose a few times and tie it securely. Repeat the process for additional amounts of fuel. For each amount added, record the corresponding fuel gauge reading on the drawing and chart below.



MARK #	AMOUNT (UNIT OF MEASURE)
1	2 U.S. GALLONS
2	
3	
4	
5	

Use the chart below to record the amount of fuel used at various manifold pressure readings.

MANIFOLD PRESSURE GAUGE READING	FUEL USED PER HOUR
INCH MAN. PRESS. =	
INCH MAN. PRESS. =	
INCH MAN. PRESS. =	
INCH MAN. PRESS. =	
INCH MAN. PRESS. =	

AMATEUR BUILT AIRCRAFT CHECKLIST

The following is to be reviewed by the Applicant for completion, as applicable, prior to the issuance of an Airworthiness Certificate by the FAA.

1. Does the builder have the registration card (FAA Form 8050-3) issued by the Registry, Oklahoma City?
2. Is registration number affixed on the aircraft in compliance with FAR 45.29?
3. Does the builder have an aircraft and engine log book? Do the log book entries, data plate, and information on FAA forms have the same builder, model and serial number?
4. Is current weight and balance recorded in a legible format? (Example Ref: FAR 43.13-1)
5. Is the word "EXPERIMENTAL" at least 2" minimum height and affixed on to the aircraft in compliance with FAR 45.13?
6. Are required instruments installed and appropriately marked?
7. Are the cockpit controls identified as to function and position? Examples: Fuel, Throttle, Carburetor heat, Flaps, Trim Tabs, etc.
8. Have all FAA closure inspections been accomplished and recorded?
9. Is the aircraft data plate attached to the aircraft?
10. Is the passenger warning placard installed?
11. Have records been maintained and recorded in compliance with FAR 91.173?
12. Is the aircraft equipped with an Emergency Locator Transmitter (ELT) in compliance with the requirements of FAR 91.52?
13. Has a radio station license been issued for the aircraft? (Note: F.C.C. Requirement, if the aircraft is equipped with a transmitter and receiver).
14. Are approved seat belts installed at all seating locations?
15. Has original and one copy of Letter of Request for Experimental and FAA Form 8130-6 been submitted as well as a 3-view drawing or photos with aircraft dimensions?
16. Is there a check list schedule of proposed flight test or aircraft operating instructions for FAA review at the time of aircraft release for flights? (Initial)
17. Has the aircraft flight, engine and landing gear been rigged and checked for proper operation to the satisfaction of the builder or as required by fabrication or manufacturer's instructions?
18. Has the aircraft fuel system(s) been leak, vent, pressure and flow checked and found satisfactory?
19. Is the aircraft considered complete in every detail by the builder?