Section 3. ENGINE NACELLE

1. FUEL SYSTEM—Look for signs of fuel dye which indicates a fuel leak. Visually check a small amount of fuel in a clear container, and drain sumps for water.

2. OIL SYSTEM—Check for indication of leaks. Check oil quantity.

3. EXHAUST SYSTEM—Check for gray-white stains, which are indications of exhaust leaks at the cylinder head or cracks in stacks. Check condition of heat muffs for cracks or leaks.

4. COOLING AIR SYSTEM (cowling and baffles)—Check for cracks in cowling and baffles. Check for proper positioning of baffles, condition of seals, and security of fasteners.

5. INDUCTION AIR SYSTEM (air filter)—Check for proper installation, condition, cleanliness, possible restrictions to airflow, and system air leaks.

6. OTHER SYSTEMS—Check for proper installation and for cleanliness.

Remove and inspect the fuel strainer screens for damage and water or dirt contamination. Clean screens, replace, and safety.

When reassembling the fuel strainer bowl, care must be exercised when tightening the bale wire. Insufficient tightening may result in leakage; excessive pressure may damage the bowl. Be sure trapped air is eliminated, ensuring unrestricted fuel flow. With fuel
A. Cylinder hold-down nuts.
B. Crankcase thru-bolts.
C. Fuel injection distributor.
D. Ignition harness.
E. Cylinder cooling fins.
F. Firewall.

G. Accessory section.
H. Magnetos.
I. Instrument system pressure filter.
J. Oil lines.
K. Cowling seals.

Figure 3-2. Inspection chart - engine.
selector and boost pump on, check the fuel strainer for leaks. Inspect fuel lines and connections for leakage, cracks, kinks, chafing, and security of mounting. Examine hoses and clamps for tightness and condition. Ensure that fuel lines do not interfere with adjacent equipment or lines.

![Figure 3-3. Fuel strainer checkpoints.](image)

Examine the primer system for general condition and perform an operational check. Inspect for leakage and security of attachment. Ensure that all conneions are tight. Copper primer lines should be periodically annealed to relieve brittleness, by a person authorized by FAR 43.

Inspect the carburetor for general condition, security of attachment, and defects. Inspect for excessive wear at throttle shaft, link assemblies, and hot air butterfly shaft bearing points. Wear can affect the fuel-air mixture resulting in erratic engine operation. Inspect for leaks due to damaged gaskets, loose fittings, or damaged fuel lines. Drain carburetor bowl and examine the gasoline for presence of water or other contamination. Remove and clean carburetor screens and inspect for damage. Flush carburetor by turning fuel supply on momentarily. Replace screens and drain plugs and ensure they are properly safetied.

Remove the carburetor air filter. Clean and inspect for defects. Inspect all air ducts for condition, alignment, and security. Reinstall filter.

Inspect the carburetor air heater for condition and security. Operate the controls through the full travel range. If a questionable condition is found, contact a certificated repair station, mechanic, or the manufacturer for repairs.

The air filter and air heater are critical inspection items. Either can restrict the intake airflow and result in loss of engine power. Follow manufacturer's instructions at all times.

Examine intake manifolds for general condition, cracks, kinks, and evidence of leakage. Ensure that upper and lower packing nuts are tight and not leaking.
A. Before cleaning.

B. After cleaning.

Figure 3-5. Carburetor air filters.

When replacements are necessary. Replacement must done by persons authorized in FAR 43.

Inspect the oil tank for evidence of cracks or oil leaks, especially around welded seams.

Figure 3-6. Intake manifold checkpoints.

If leaks around the intake pipe packing nut cannot be corrected by tightening the nut, the packing must be replaced. Use approved parts.

Figure 3-7. Oil tank inspection.
and fittings. Leaks should be traced to their source and corrected.

Check the oil tank retainer straps for evidence of chafing and for security of attachment. If chafing has occurred or the proper security cannot be obtained, antichafe pad replacement is necessary.

Figure 3-8. Oil quantity check.

On wet sump engines, inspect the sump for evidence of leaks. Remove oil sump plug and inspect for foreign particles. Remove, inspect, and clean oil sump strainers. Reinstall drain plugs and strainers, and safety immediately. The presence of metal particles usually indicates an internal failure. It will be necessary to make a thorough internal inspection of the engine which, in most cases, requires a complete engine disassembly. Fill the system with the type and grade of oil recommended by the manufacturer, for the climatic conditions to be encountered.

Inspect oil lines for leakage and security of attachment, particularly at connections. Oil hoses should be inspected for exterior checks.

Figure 3-9. Satisfactory oil line installation.

Figure 3-10. Unsatisfactory oil line installation.
and cracks, and proper tension and location of clamps. Any leaks must be repaired immediately.

FIGURE 3-11. Oil-cooler checkpoints.

If the lubrication system incorporates an oil cooler or radiator, examine it very carefully for leaks, defects, and security of mounting. Any leaks or defects will require replacement of the unit before further service.

Using a torque wrench, check the tightness of the spark plugs to the torque recommended by the manufacturer.

Examine ignition wiring and connections for general condition. Inspect spark plug barrels, elbows, and knurled nuts for proper tightness. Inspect shielding and bonding for condition and security.

Periodically inspect spark plug “cigarettes” for cleanliness, cracks, and broken spring contacts. Figure 3-13 shows a burned spark plug cigarette. For maximum efficiency of the ignition system, this spark plug cigarette should be replaced.

CAUTION

If your engine is a gas-turbine type, its ignition system is entirely different from that used on reciprocating engines. Work on turbine engine ignition systems can result in SEVERE BODILY INJURY OR DEATH due to electrical shock, unless you are fully familiar with recommended procedures. Figure 3-14 shows the normal condition of a gas turbine igniter plug and illustrates how they differ from spark plugs.

FIGURE 3-12. Checking sparkplug torque.
Figure 3-13. Unsatisfactory sparkplug cigarette.

Figure 3-14. Igniter plug – gas turbine engine.

Figure 3-15. Exhaust manifold checkpoints.
Be certain that the magneto holddown nuts are tight and properly safetied. If the holddown nuts are loose, it will be necessary to check the magneto timing to make sure it has not been disturbed and technical assistance should be sought. Inspect magneto and cover screws for security.

Check magneto ground wires for condition and proper attachment to the magneto terminal and the ignition switch. If the magneto is not properly grounded, it is possible for the engine to operate, even though the magneto switch is in the “OFF” position. A check of this “OFF” position should be made a regular part of each engine shut down after each flight. BEWARE OF THE PROPELLER, even when the switch is “OFF”—especially when the engine is warm.

Inspect each exhaust stack for condition and security of attachment. Examine the entire collector ring or manifold for cracks, failure of the joints, or other indications of deterioration. Check that no portion of the engine cowling has been in contact with the collector ring or stacks. Be certain that all support bolts are tight and safetied.

Inspection of the engine exhaust system should be thorough to ensure there are no defects that might permit an open flame to enter the engine compartment and present a fire hazard. Exhaust leakage can be identified by flame or smoke “tracks” (gray-white de-

A. Tailpipe burned.
B. Exhaust deposits.

FIGURE 3-16. Exhaust stack damage.
posits) at a break in the system or on the adjacent area where exhaust gases impinge.

Figures 3-16 shows an example of exhaust outlet damage “A” and evidence of exhaust deposits “B.”

On turbine engines, check the tailpipes and trim devices to see that they are not cracked and are in order. Check the controls for freedom and alignment. Any binding or malfunctioning of an engine control system should be traced to its source and corrected.

Figures 3-17 shows a heat exchange shroud opened for inspection. Arrows indicate areas which are prone to failure.

Remove the heater shroud from the exhaust manifold or muffler and inspect for cracks, burned-out spots, or defective welds. Determine that shutoff valves are operating through their full travel. Ensure cold air and heater ducts are free from obstructions and cracks, and are properly secured. If the heater incorporates an intensifier tube inside the exhaust ring or manifold, it should be removed and inspected for cracks or burned-out spots. Defects noted in the heater system must be repaired or the unit replaced immediately to assure that carbon monoxide or flames will not enter the cabin or cockpit. When an exhaust

Figure 3-17. Heat exchanger shroud removed.
leak is indicated or suspected during flight, open the cabin windows. Turn the cabin heat “OFF” and fresh air ventilation “ON” to avoid carbon monoxide poisoning. Do not use these procedures to initiate a flight with known exhaust system or heater defects. 

Operation of the cowl flaps is of vital importance in keeping cylinder head temperatures within the required operating range.

Determine that cowl flaps are in good condition; the hinges are not worn beyond limits; and the actuation mechanism is properly rigged for full travel and is operating properly. Cowl flaps must be maintained in good operating condition at all times in order to obtain required engine efficiency.

Figures 3-19 shows example of two types of repairs to engine baffles. “A” is a sheet metal reinforcement for a broken holddown bolt hole. “B” is a welded repair in a similar area.

Check baffles for security, holes, cracks, and proper fit around the cylinders. Inspect all air entrances and exits for deformations which might obstruct airflow.

Pressurized air is required for engine cooling; therefore, any leak around or through baffles causes a pressure drop and loss of cooling efficiency.

Use a drop light or flashlight to look through the nose cowling and check for gaps between the top cowling and engine baffles.

Inspect engine cylinders for cracked or broken fins.

Some engine mounts are heat-treated and may not be repaired by welding unless normalized and reheat-treated to their previous strength values. When cracks or inferior welds are found in such units, replacement or repair by the manufacturer or authorized repair facility is necessary. Nonheat-treated engine mounts may be repaired by welding if the work is performed in accordance with the manufacturer’s instructions and is done by a person authorized in FAR 43.
A. Sheet metal reinforcement.
B. Welded.

**Figure 3-19.** Engine baffles.

**Figure 3-20.** Engine mount checkpoints.

**Figure 3-21.** Cracked engine mount.
Examine the entire engine mount structure with a magnifying glass, especially at welds. Look for evidence of cracks or failure and inferior welds. Ensure that all attachment bolts are tight and properly safetied.

Inspect the mounting of all accessories such as generator, starter, oil pump, oil pressure relief valve body, etc., for security of attachment, oil leakage, and proper safetying. If oil or other fluid is detected around any of the accessories, the unit should be removed and the leakage corrected.

When combustion heaters are installed, inspect for security of mounting and proper installation of hot and cold air intake ducts. Inspect fuel lines for condition, leaks, attachment, and freedom from obstructions and kinks.

With heater switch “ON,” check the solenoid valve to determine whether it is operating satisfactorily. If no clicking can be heard in the solenoid, it should be removed, cleaned, and...
inspected. Ensure that exhaust and overflow lines are properly routed through the structure to the outside air.

Inspect engine cowling for defects such as cracks, dents, chafing on portions of the engine or aircraft structure, and loose rivets, clamps, fasteners, or other locking devices.

After completion of cowling repairs, reinstall and check for proper fit and security.

The presence of black or dark streaks on aluminum structure usually indicates chafing caused by vibration and looseness.

Check condition of the firewall behind the engine. Inspect insulation for condition, attachment, and for oil or fuel saturation.

Oil or fuel saturation of insulation material presents a serious fire hazard. The source of the oil or fuel must be located and the leak corrected. The saturated insulation should be removed and cleaned if possible. If cleaning is impossible, the insulation must be replaced.

Figure 3-23. Inspect cowling for damage.

Figure 3-25. Repaired cowling.
Figure 3-26 shows the results of improper fit of the engine access cowling. Note arrow pointing to hole worn in nacelle fairing.

Battery Maintenance Precautions

It is a good practice to protect the area adjacent to the battery with an acid-proof paint if it is a lead-acid battery, or an alkaline base paint if it is a nickel-cadmium battery.

When working around the battery, care should be exercised to avoid short circuiting across the terminals. Resultant arcing presents a serious fire hazard. As a safety precaution, the battery should be removed during cleaning and repair operations. Remove the “ground” terminal first, and reinstall it last.

Lead-Acid Battery Inspection and Service

Check the battery box and terminals for corrosion and security. Inspect vents and overflow lines for condition and obstructions. These lines should be routed to prevent overflowing liquid from contaminating and corroding the adjacent structure.

Check the charge of a lead-acid battery by using a hydrometer. When the hydrometer test indicates a variance of more than 20 points between cells, the battery should be recharged or replaced.

If the electrolyte in a lead-acid battery is low, replenish it with distilled water to the specified level. A 30-minute flight should be sufficient operating time before conducting a hydrometer test after refilling.
Nickel-Cadmium Battery Inspection and Service

Check the battery box and terminals for corrosion and security. Inspect vents and overflow lines for condition and obstructions. These lines should be routed to prevent overflowing liquid from contacting and corroding the adjacent structure.

Check the individual cell voltages. If an unbalanced condition exists, maintenance by a certificated mechanic or certificated repair station is required.

White powder on top of the battery indicates spillage of the electrolyte and requires the same action as the unbalanced condition.

Maintenance should be done in accordance with the manufacturer's specifications.