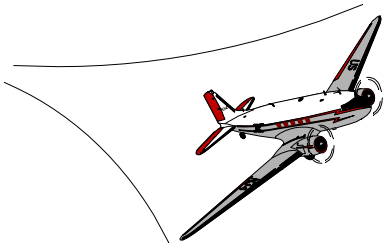
SPECIAL AIRWORTHINESS INFORMATION BULLETIN



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This is information only. Recommendations aren't mandatory.

Introduction

This Special Airworthiness Information Bulletin (SAIB) advises you, owners and operators of **reciprocating engine powered airplanes** and anyone else who may deal with **exhaust system components**, of the importance and need to properly inspect and maintain the components. You can apply our recommendations to any reciprocating engine powered airplane's exhaust system components.

Background

Review of accident/incident reports reveal that there have been numerous fatalities and injuries to pilots and passengers as a result of exhaust system component failures. We have identified the probable causes for these accidents and incidents as:

- Carbon Monoxide (CO) poisoning
- Partial or complete loss of engine power
- Fire
- A combination of the above

We received a Safety Recommendation concerning a muffler internal failure of a cone on a Cessna 207 airplane. The cone blocked the exhaust gas outlet flow resulting in engine power loss on take-off. This muffler configuration is common or similar to many other general aviation airplane mufflers.

We want to emphasize the safety hazards and potential dangers of inadequate and infrequent inspections and of a lack of a routine preventative maintenance on exhaust system components between interval inspections. **You should regard any exhaust system component failure as a severe hazard**. Many light airplane cabins are warmed by air that has been circulated around the engine exhaust pipes or a bellows by a shroud or a muffler with an exhaust gas to air heat exchanger (heat exchanger) under a shroud that is in line with the exhaust pipe(s). Many of the most common exhaust system component failures are muffler or exhaust gas to air heat exchanger related. *Some of these failures are:*

- Muffler or heat exchanger leakage, which permits exhaust gas to escape and directly enter the cabin or enter through the cabin heat system.
- Muffler or heat exchanger, heat transfer pins or knobs. These can be found under the shroud on heat exchangers or mufflers that function as both a heat exchanger and muffler. Pin or knob failure can lead to leakage of the exhaust gas directly into the cabin or through the cabin heat system.
- Muffler or heat exchanger, loose or internal failure of baffles, cones or diffusers can partially or completely block the exhaust gas outlet flow, which can lead to partial or full engine power loss. This condition may occur intermittently if internal components are loose within the muffler and move around during subsequent flights

Recommendations

Inspections and Checks
All inspections, checks, and processes should be in accordance with the manufacturers recommendations.
We highly recommend thorough pre-flight and repetitive inspection of the exhaust system components because failures can occur in a relatively short time. All airplane owners and operators should acquaint themselves with the configuration, pieces and parts that make up the exhaust system on their airplane. This will assist in any pre-flight or inspection to identify areas that are not normal or that may have changed since last review.

You should do daily inspections, if your airplane is flown often. This consists of a visual inspection of the complete exhaust system installation. Simple tools such as a flashlight, mirror, awl or pick, and length of small diameter wooden dowel rod or solid core wire may assist in this process. This inspection should consist of checking the exposed exhaust system components and vicinity.

Typical areas to check and potential problems are:

1. *All external surfaces for signs of leakage.*
    - Leakage presents as a flat gray, gray-white or light gray powdering, or a sooty appearance. Signs of deterioration include warping, deformation, thinning, collapse, dents, cracking, tears, separation, scaling, weld separation, discoloration, corrosion, metal pitting or burn-thru. Muffler or heat exchanger housing corrosion can often be determined before the corrosion breaks thru the most outer surface by examining the area of the muffler at either end where the end plate (which adapts the connection for the inlet or the outlet) is inserted into the muffler shell. If corrosion is advancing in this area, a swelling often occurs that can be seen as a raised area off the normal surface line of the muffler surface at either end. Any protrusion in the exhaust gas flow such as dents can result in localized hot spots which can lead to burning, bulging, or rupture at those locations.

2. *All external joints, flex-joints, slip-joints, clamps, couplings for misalignment, warpage, broken, loose or missing fasteners, clamps, gaskets or seals and abnormal wear.*
    - Signs of leakage such as flat gray, gray-white or light gray powdering, or a sooty appearance.

3. *All interior areas for blockage, restrictions, dents or protrusions into the exhaust flow path.*
    - Using a flashlight, look in the interior of the tailpipe for loose or displaced baffles, cones or diffusers in the mufflers. On airplanes that have a bend in the tail pipe, it may be advantageous to remove the tailpipe at least at annual inspection for interior inspection of the muffler. Look for the accumulation of deposits from coking/carbonization, which can form, grow and create an ember or localized hot spot or component mal-function or failure. Signs of erosion or abnormal wear can be found where directional changes are made in the exhaust gas flow.

4. *Muffler, heat exchanger, bellows or shrouds, heat transfer pins or knobs, baffles, cones or diffusers or support rods.*

5. *Stack or riser to flange interface for cracks in welds or weld heat affected area, blown out or missing gaskets.*

6. *All welds and area adjacent to the weld for cracks or weld separation.*

7. *Tailpipes, for erosion, thinning, bulging or burn through.*

8. *Contoured, shaped or bend areas, turns and interfaces (wyes) for erosion, thinning, bulging or burn through.*

9. *Fluid or moisture traps, for scaling, corrosion, or cracks.*

10. *Bracing, supports and support attach lugs on other structures for security and self locking or safetied hardware, and signs of overheat or burning.*

11. *Surrounding structures for discoloration, heat damage, or burning.*
    - Impingement heating or torching of the surrounding structure can occur in any area where exhaust system components exist or are breached, and may lead to failure or fire conditions. Torching is of particular concern on turbocharged engines, which operate at higher exhaust gas temperatures and pressures.

12. *Usage of non-high temperature materials, or non-self-locking or unsafetied hardware.*

The exhaust system components should be inspected thoroughly at any inspection interval, noting at least those areas above. The above inspections may be more practically implemented at intervals such as at an engine oil change. The exhaust system can also be pressure tested on the aircraft with reasonable results that will usually show leaks.

A vacuum cleaner with the hose attached to the blowing side of the vacuum (with a filter installed) can be attached to the aircraft tailpipe and sealed securely. The vacuum will pressurize the system sufficiently for a soap solution to be brushed or applied from a spray bottle to the surface and contours of the exhaust system and will show breaches (leakage) in the system from cracks and corrosion. If the particular aircraft service manual does not specify such a test at the aircraft annual inspection, it is highly recommended that this be accomplished. This test is also recommended anytime exhaust system components are removed or replaced.

It may be advantageous to remove the exhaust system components to a certain extent to enhance inspections and checks. Total removal may also be required if there is a need for a pressurized leak test in a water tank. We also recommend that exhaust systems be completely inspected when the major work or overhaul of the aircraft engine is accomplished. Airplanes that do not operate more or less on a continual basis or those located in humid climates are also more likely to have a higher rate of exhaust system component deterioration. Always use new gaskets or seals when replacing or reinstalled the exhaust system components.

Allow the system to attain normal operating temperature prior to checking the exhaust system after shut down for leaks. Re-align the exhaust system components if necessary after run-up to preclude preloading the components. Re-torque all fasteners, taking care to not preload any of the components. If hardware cannot be re-torqued to proper settings, the hardware should be replaced as it may have stretched or deformed over time. Safety everything as required.

Repairs and Overhaul

Cessna recommends that you replace any exhaust system component that fails maintenance manual inspection procedures or that you find defective. Generally, it is recommended you replace exhaust system components that are burned, cracked, warped, or so worn that leakage occurs. Weld repairs to exhaust system components are complicated by the constant deterioration of the base materials, proper identification of the base materials, the generally thin base materials, changes in the base materials composition and grain structure, and the contaminants and deposits that exist on any component after a short period of time.

We strongly encourage consulting with an FAA approved Repair Station that has experience and a demonstrated expertise in exhaust system inspection and repair prior to attempting the repair of any exhaust system component. We also recommend a pressure test after any repair to a welded component of the exhaust system.

For Further Information Contact

Jeff Janusz, Senior Aerospace Engineer, FAA Wichita Aircraft Certification Office, 1801 Airport Rd, Rm 100, Wichita, Kansas, 67209; phone (316) 946-4148; email: jeff.janusz@faa.gov