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PREPARED BY:	T. Strohmayer
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REVISION CONTROL

REVISION	DATE	REMOVE PAGES	INSERT PAGES
IR	2/26/02	N/A	N/A
A	08/30/02	1-10	1-5
B	07/02/04	1,4,5	1,4,5
C	05/21/07	3-5	3-5
D	SEP/29/2010	All	All

Description of Changes (Rev D):
Updated Format. Expanded troubleshooting chart. Added reference to Hartzell 3-Blade propellers. Specified anti-seize grade. Added paragraph 2.4 for maximizing service life. Provided more details in removal paragraph.

F. A. A.
APPROVED*
ATLANTA AIRCRAFT CERTIFICATION
OFFICE CENTRAL REGION
BY:
DATE: 10-25-2010

* ACI (SECTION 2.2) ONLY

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1.0 Introduction

Note: PFS is the abbreviation for Power Flow Systems, Inc.

1.1 Description

This modification is a tuned exhaust system on the Cessna 177, 177A, and 177B aircraft. The tuned exhaust is made from stainless steel and is installed in lieu of the standard Cessna exhaust. The tailpipe is supported by a bracket attached to the lower right engine mount.

1.2 Update Procedure

It is the responsibility of the aircraft owner/technician to ensure that the most recent revision of these instructions is followed. The most recent revision of this report can be obtained by calling Power Flow Systems, Inc. at (386) 253-8833 or online at www.powerflowsystems.com.

2.0 Continued Airworthiness Instructions

2.1 Basic Operation

Basic operation of the airplane remains the same. The pilot must watch to ensure that redline of the RPM is not exceeded.

2.2 Airworthiness Limitations

The Airworthiness Limitations section is FAA approved and specifies maintenance required under §§43.16 and 91.403 of the Federal Aviation Regulations unless an alternative program has been FAA approved.

2.2.1 Mandatory Replacement Time – None.

2.2.2 Structural Inspection Interval – The exhaust system must be inspected in accordance with this document at 100 hour or Annual intervals (whichever comes first).

2.2.3 All slip joints must be disassembled and lubricated with a high-temperature anti-seize compound meeting or exceeding MIL-A-907E at 500hr or Annual intervals (whichever comes first). While disassembled, inspect for wear or galling. This shall be performed more frequently if headers seize between inspections.

2.2.4 Verify the following:

- Placard is visible to pilot that states “The Power Flow Systems, Inc. tuned exhaust system installed on this aircraft may cause the aircraft to burn more fuel at certain power settings. It is the Pilot’s responsibility to determine what, if any, change in fuel flow exists and to plan accordingly.”
- If the aircraft is equipped with a Hartzell 3-blade propeller model HC-C3YR-1RF/F7282 installed via STC # SA1556GL:
  - Verify the Hartzell Flight Manual Supplement is P/N AFMS_011210 Rev. B or later.
  - Verify the placard between the manifold pressure gage and tachometer that reads: **AVOID CONTINUOUS OPERATION BELOW 22 INCHES HG BETWEEN 1950 AND 2350 RPM** (Replace the existing placard if it reads differently).

2.2.5 Contact Power Flow Systems, Inc. or Hartzell Propeller for the AFMS and Placard if required.

2.2.6 Structural Inspection Procedure: See Section 2.6 below.

2.3 Troubleshooting

Problem	Possible Cause	Solution
Exhaust smell or carbon monoxide in cockpit	Exhaust Leak, opening in firewall or fuselage	Immediately inspect exhaust system and airframe for leaks, **do not return to service until problem is resolved.**
Excessive vibration	Tailpipe or support rod contacting cowling	Check for wear marks on the engine cowling, reposition tailpipe or trim opening as necessary.
	Collector not centered on header pipes	Reposition collector -- ensure minimum of 1 1/2" penetration per header into central collector system
	Broken Clamps	Replace Broken Clamps
	Propeller not properly balanced	Have propeller dynamically balanced to at or below 0.2 ips.
	Worn Engine Mounts	Inspect Engine mounts and replace if necessary. Verify that mounts are shimmed in accordance with the Cessna Cardinal Service Manual.
Excessive noise	Muffler insert damaged or missing	Contact PFS, Inc. for new muffler insert kit, PFS-8016.
Staining at or near slip joints.	Exhaust Leak or Anti-Seize stain.	Anti-Seize will creep from slip joints and appear as a stain, this is not a problem. Exhaust leaks from slip joints are extremely rare, but if stains are determined to be from exhaust, the slip joints should be reworked for better fit by carefully expanding the inside tube until it fits tightly within the outer tube.

2.4 Maximizing Service Life

To get the maximum possible service life from your Power Flow Systems Tuned Exhaust, follow these steps:

2.4.1 Dynamically balance your propeller to below 0.2 ips (inches per second) every 4 years or 1000 hours (whichever occurs first).

2.4.2 Dynamically balance your propeller to below 0.2 ips after modifying, overhauling, dressing, or replacing any rotating component on the engine or propeller.

2.4.3 Keep slip joints lubricated with a high temperature anti-seize (MIL-A-907E or equivalent).

2.4.4 Maintain even engine compressions above 70/80 psi.

2.4.5 Keep magnetos in good working order and ensure that mag drops are even and less than the maximum recommended by the aircraft manufacture.

PLEASE NOTE THAT FAILURE TO COMPLY WITH ONE OR MORE OF THESE STEPS MAY IMPACT THE PRODUCT WARRANTY. PLEASE CONSULT YOUR WARRANTY DOCUMENTATION FOR FURTHER DETAILS.

2.5 Removal

2.5.1 Disconnect muffler support rod P/N 90030 or 90077 from muffler clamp P/N 8030.

2.5.2 Disconnect exhaust clamp P/N 7020 and remove muffler assembly P/N 80177 from collector.

2.5.3 Remove lower cowl IAW the latest FAA approved revision of the Aircraft Service Manual

2.5.4 Disconnect flexible ducts from collector assembly.

2.5.5 Remove EGT probes if installed.

2.5.6 Mark each of the header pipes with their respective cylinder number with a felt tipped pen or marker. Also mark the insertion depth and rotation angle of the header slip joints. DO NOT MARK EXHAUST PIPES WITH A PENCIL OR ANY OTHER GRAPHITE OR CARBON BASED MARKING DEVICE.

2.5.7 Remove exhaust pipes from cylinders 2 and 4 and separate them from the collector assembly.

2.5.8 Remove the collector assembly by pulling out from the 1 and 3 cylinder side.

2.5.9 Remove the 1 & 3 headers.

2.5.10 Remove the engine mount bolt and support rod if necessary.

2.6 Inspection

The exhaust system must be thoroughly inspected, especially within the heat exchanger section. A detailed inspection of the exhaust system must be performed in accordance with the this document at either 100 hour or Annual intervals. All components displaying cracking or general deterioration must be replaced with new parts or repaired in accordance with the latest approved revision of AC 43.13.

2.6.1 Remove engine cowling.

2.6.2 Be sure that the installation allows a minimum of 2" clearance between unshielded exhaust tubes and fuel and oil lines or battery cables. Verify that fuel, oil, and electrical lines are properly supported. Nylon, plastic, or rubber ties can melt and cause fuel, oil, or electrical lines to fall onto exhaust system components.

2.6.3 Loosen shrouds so that all surfaces of the exhaust system are visible.

2.6.4 Check for holes, cracks, and burned spots. Especially check areas adjacent to welds. Look for exhaust gas deposits in surrounding areas. Look for unusual tube discoloration. This may indicate an exhaust leak.

2.6.5 Inspect the packing material in the muffler body. If the packing is missing, collapsing, or deteriorated, it will require replacement. New packing inserts are available from Power Flow Systems, Inc.

2.6.6 Verify that a placard is installed in clear view of the pilot that reads: "The Power Flow Systems, Inc. tuned exhaust system installed on this aircraft may cause the aircraft to burn more fuel at certain power settings. It is the Pilot's responsibility to determine what, if any, change in fuel flow exists and to plan accordingly."

2.6.7 Inspect screen covering carb heat outlet. Screens must be secure with no risk of material breaking off.

2.6.8 Inspect pin on clamp. Pin should not indicate excessive wear or cutting. If worn or cut contact Power Flow Systems, Inc. for replacement.

2.6.9 Inspect hole that pin is inserted in for elongation. If elongated contact Power Flow Systems, Inc. for replacement.

2.6.10 All slip joints must be disassembled and lubricated with a high-temperature anti-seize compound (MIL-A-907E or equivalent) at 500hr or Annual intervals, whichever comes first. This should be performed more frequently if headers seize between inspections. While disassembled, inspect for wear or galling.

2.6.11 If any defects (cracks, burns, etc.) on the collector assembly (other than on the shroud) are noted during the visual inspection, then the collector needs to be pressure tested using the procedure below:

- Remove exhaust pipes and heat exchanger assembly.
- Remove shrouds.
- Seal openings with expansion rubber plugs.
- Submerge the collector assembly in water.
- Using a manometer or pressure gauge, apply 3.0 to 3.5 PSI (approximately 7" Hg) of air pressure.
- Let the unit sit pressurized for 10 to 30 seconds. The leak rate should be zero.
- If a leak is found in the collector assembly, replace before further flight.
- If no leaks are found, dry components and install on airplane.

3.0 Installation

Contact Power Flow Systems, Inc. for the latest FAA approved revision of the installation instructions, report PFS-13750-00.