REPORT NAME:
INSTALLATION INSTRUCTIONS AND INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

POWERFLOW SYSTEMS, INC

1585 Aviation Center Parkway
Hangar 804
Daytona Beach, FL 32114

REPORT NUMBER: PFS-15150-00

KIT NUMBER: PFS-15101

REVISION: B
REPORT DATE: 04/20/2007

PREPARED BY: Tom Strohmayer

DISTRIBUTION: FAA ATL ACO, END USER

F.A.A
APPROVED
ATLANTA AIRCRAFT CERTIFICATION
OFFICE CENTRAL REGION
By: R.A. Boyle
Date: 4/30/2007

Submitted to FAA ACO

By: _____ Date: APRIL 20, 2007

REVISION CONTROL

REVISION	DATE	REMOVE PAGES	INSERT PAGES
IR	03/30/2006	N/A	N/A
A	10/16/2006	ALL	ALL
B	04/20/2007	5,6,7	5,6,7

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PFS-15101

1.0 INTRODUCTION

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

Description: The PFS exhaust consists of an exhaust pipe from each cylinder to the collector assembly located beneath the engine. The collector assembly is enclosed in a shroud, which captures ram air from the engine compartment baffle to be heated by passing around the collector assembly's inner tubes. This heated air is used to heat the aircraft cabin. A separate compartment of the collector assembly furnishes heated air for carburetor heat. A tailpipe from the collector assembly routes exhaust gases to a muffler that directs gases out of the cowling.

Please read these directions and Instructions for Continued Airworthiness completely before starting installation.
Please call us at 386-253-8833 during normal business hours if you have any questions regarding the installation of this kit.

Please Note: The Power Flow Systems Exhaust has been designed and FAA certified to be installed in accordance with these instructions. *Any* modification to the exhaust system or its components, or any deviation from these instructions without express written permission from Power Flow Systems, Inc. invalidates the design and the FAA approval. Any such modifications or deviations will also void the exhaust system warranty.

2.0 KIT CONTENTS

Each Power Flow exhaust kit is shipped with:

4	Headers	PN: 11500, 12500, 13500, 14500
4	No-blow Header Gasket	PN: 77611
8	Exhaust Nut	PN: SL-STD-1410 (or Stainless Equivalent)
8	Lock Washer	PN: MS35333-41
8	Plain Washer	PN: AN960-516
1	Shrouded Collector Assembly	PN: 41550
1	Intermediate Tube	PN: 78106
1	Muffler Assembly	PN: 80061
6	Drilled Bolt	PN: AN3C12
6	Castle Nut	PN: AN310C3
12	Flat Washers	PN: AN960C10
6	Ball Joint Springs	PN: 33703
7	Cotter Pin	PN: MS24665-153
1	Muffler Clamp	PN: 8031
1	Drilled Bolt	PN: AN4C5
1	Castle Nut	PN: AN310C4
2	Flat Washer	PN: AN960C416
1	Firewall Bracket	PN: 91500
2	Bolts	PN: AN3-27A
4	Flat Washers	PN: AN960-10
2	Lock Nuts	PN: MS21045-3
1	Bolt	PN: AN3C5A
1	Large Area Washer	PN: AN970-3
1	Stainless Steel Lock Nut	PN: MS21045C3
A/R	Exhaust Strap Material	

Note: Equivalent Hardware may be supplied throughout. Supplied hardware may vary.

3.0 PREPARATION

Verify that all contents listed on page 4 of this instruction set are included in your kit. Read all instructions before attempting installation, to become familiar with the procedure. If you have any questions regarding the installation, please call (386) 253-8833 *before* attempting installation.

3.1 - Remove stock exhaust system (if installed) in accordance with the latest approved revision of the aircraft service manual.

3.2 - Modify the oil cooler SCAT flange on the forward baffle to slope downward at a greater angle. It may be necessary to test fit the exhaust several times to obtain sufficient clearance.

3.3 - It may also be necessary to relocate the fuel line and the fuel flow transducer further inboard for adequate clearance to the number four header. Aeroquip Hose Assembly P/N AE3663163G0114 may be used to replace the original hose to obtain sufficient clearance. Again, it may be necessary to test fit the header to ensure a minimum of two inches of clearance.

3.4 – Heat Shield Relocation: It may be necessary to relocate cowl heat shields to avoid paint discoloration over the long term. It is recommended that the pilot side heat shield be relocated so that the aft edge of the shield is 9.5 inches forward of the aft edge of the lower cowling. The vertical positioning does not change; keep the bottom edge of the heat shield at the top of the radius on the lower cowling. It is also recommended that an additional heat shield be added on the passenger side to mirror the pilot side installation, but with an aft edge of shield to aft edge of cowl distance of 12.5".

3.5 – Fuselage Trim: In order to maximize clearance to the tailpipe, the bottom forward edge of the fuselage on the passenger side should be chamfered. With the upper and lower cowlings removed, locate the edge of the fuselage just forward of the firewall on the passenger side. This is a narrow strip to which the female cowl fasteners are attached. Follow the strip down and inboard until it terminates a few inches outboard of the aluminum drain tube. This strip has a 90-degree corner just at the lower cowl opening. Chamfer this corner at approximately 45-degrees back to the firewall, being careful not to encroach on the lower most cowl fastener.

4.0 INSTALLATION OF PFS EXHAUST SYSTEM

NOTE: If you are installing EGT probes, we recommend locating and drilling the holes for the probes in the headers in accordance with the latest approved revision of the Aircraft Service Manual (typically 2 to 4 inches from the exhaust port). Holes may be pre-drilled.

4.1 - Installing Collector Box Assembly and Exhaust Pipes

NOTE: Each header and collector is marked with its appropriate cylinder number – make sure that each header installed matches the correct collector location.

4.1.1 – Apply generous amounts of high-temperature anti-seize to the slip joints on the collector box.

4.1.2 - Insert headers into the collector box according to the numbering on the headers and collector box.

4.1.3 - The header pipes must be installed at least 1 1/2" into the collector assembly. Align each header with the factory's alignment marks to ensure correct orientation and adequate installation depth.

4.1.4 - Put new exhaust gaskets into position on each cylinder. It is suggested that you keep them in place temporarily with either a loop of safety wire or a large cotter pin. Lift and hold the assembly into position. It may be necessary to temporarily change alignment on one or more of the headers in order to install the collector box into position.

4.1.5 - Install a washer, a lock washer and a nut on each stud (there are 8 sets of these). If utilized, remove the loops of safety wire or cotter pins. **See Detail "A."** The installer may alternatively use STD-2233 nuts with STD-35 washers instead of the hardware listed in the kit contents. Torque the exhaust nuts to final torque **after** proper orientation and assembly position of the exhaust system is achieved. Header pipes should have 0.100 inches clearance between them. There should also be a minimum of 3/16-inch clearance between the collector box and the carburetor and 1/16-inch between the collector box and oil sump.

4.1.6 - Torque headers to 200 in-lbs unless otherwise specified in the latest approved revision of either the Aircraft or Engine Service Manual. Remove alignment labels.

4.1.7 - Attach all flexible tubing to the appropriate inlet/outlet tube on the collector assembly.

4.2 - Installing the Firewall Bracket

4.2.1 - Remove the two bolts on either side of the fuel line bulkhead fitting (someone will need to put a wrench on the nuts inside the cockpit, forward of the passenger side rudder pedals).

4.2.2 - Install the firewall bracket to the firewall using the AN3-27A bolts, AN960-10 washers, and MS21045-3 lock nuts provided.

4.3 - Installing the Tailpipe

4.3.1 - Install the intermediate tube to the collector box outlet using hardware provided. **See Detail "B".**

4.3.2 - Position the tailpipe so that it will be in the correct position for clamping to the exhaust hanger. Using the hardware provided, assemble the second ball joint. **See Detail "B".** The compressed spring height on the ball joints should be between 0.430 and 0.475 inches add or remove washers as necessary.

4.3.3 - At this stage, the lower end of the tailpipe assembly should be able to 'wobble' ½ inch to 1 ½ inches from side to side.

CAUTION

Over-tightening the ball joint assembly may cause cracking in the 4 to 1 collector and damage to the ball joint assembly.

4.3.4 - Attach the muffler clamp, P/N 8031, to the tailpipe assembly. **See Detail "C".** Position the clamp as necessary for attaching to the tailpipe hanger. The tailpipe should be approximately ¼ inch from the aluminum "ramp" attached to the lower firewall. A minimum 0.5" clearance is recommended on all sides, but there should be no more than 2" of clearance on the outboard side.

4.3.5 - Drill a 3/16 inch hole through the neoprene and clamp tab and assemble as shown in **Detail C**. The hole in the clamp may have been predrilled, if so, transfer hole location to the neoprene.

4.3.6 - Patch the existing tailpipe opening in the lower cowling IAW the latest approved revision of AC43.13 or the Aircraft Manufacturer's recommendations (if applicable). If there are no specific manufacturer recommendations, comply with the latest approved revision of FAA AC 43.13.

4.3.7 - Relocate battery box drain by installing a hose over the existing drain and routing the hose to allow the battery box to drain at least three inches from any exhaust component. Angst & Pfister GesmbH hose P/N 550310004 may be used for this application. The hose may be routed from the existing drain to the inboard side of the aluminum tube that exits the lower cowl. Tie-wrap the hose to the inboard side of the aluminum tube at multiple locations so the hose exits the lower cowl. The hose should be clamped to the existing drain using a RB51370 hose clamp or equivalent.

Make appropriate entries in the logbook and on a FAA Form 337 (if applicable). The STC is located at the back of this instruction set for easy removal.

Typical Weight and Balance Information: The Power Flow Exhaust system weighs approximately 20.4 lbs at station 43.0.

5.0 INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

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 obtained by calling Power Flow Systems, Inc. at (386) 253-8833 or online at www.powerflowsystems.com

5.1 – Basic Operation

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

5.2 – 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."

5.2.1 - Mandatory Replacement Time – None. Any collector assembly that is damaged and/or fails the pressure test described below must be replaced.

5.2.2 - Structural Inspection Interval – At 100 hour or Annual intervals, depending on the service regime of the aircraft. **WARNING: Carbon Monoxide gas present in exhaust gases can lead to pilot incapacitation and/or death. A damaged exhaust system has the potential to allow Carbon Monoxide into the aircraft cabin. To prevent such an occurrence, it is imperative that the exhaust system is inspected using the intervals and procedures described in this report. It is recommended that in-cabin carbon monoxide levels be measured periodically. Concentrations of greater than 50ppm will require immediate exhaust system repair or replacement.**

5.2.3 - Structural Inspection Procedure – See Section 7.0 Below.

5.3 - Troubleshooting

Problem	Possible Cause	Solution
Exhaust smell in cockpit	Exhaust Leak	Immediately inspect exhaust system for leaks, **do not return to service until problem is resolved.**
Excessive vibration	Tailpipe contacting firewall or cowling	Check for wear marks on the lower firewall and engine cowling, reposition tailpipe as necessary.
	Collector not centered on header pipes	Reposition collector -- ensure minimum of 1 1/2" penetration per header into central collector system
	Ball Joints too Loose	Tighten Ball Joints
	Broken Exhaust Hanger	Replace Exhaust Hanger
	Propeller not properly balanced	Have propeller dynamically balanced
Excessive noise	Muffler insert damaged or missing	Contact PFS, Inc. for new muffler insert, PN PFS-8016

5.4 - Maximizing Service Life

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

5.4.1 Dynamically balance your propeller to below 0.2 ips (inches per second) every 2 years or 1000 hours (whichever occurs first).

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

5.4.3 Keep slip joints lubricated with a high temperature anti-seize.

5.4.4 Maintain even engine compressions above 70/80 psi.

5.4.5 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.

6.0 REMOVAL OF PFS EXHAUST SYSTEM

6.1 - Disconnect muffler clamp P/N 8031 from the exhaust hanger.
6.2 - Disconnect the ball joint assemblies. Remove muffler.
6.3 - Remove EGT probes, if installed.
6.4 - Disconnect flexible ducts from the collector assembly.
6.5 - Remove nuts and washers attaching headers to exhaust ports.
6.6 - Remove the collector assembly.

7.0 INSPECTION

The exhaust system must be thoroughly inspected, especially within the heat exchanger section. A detailed visual inspection of the exhaust system must be performed in accordance with the latest revision of the Aircraft Service Manual 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.

7.1 - 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.

7.2 - Inspect screen covering carb heat outlet. Screen must be secure with no risk of material falling off.

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

7.4 - Inspect for ball joint freedom of movement by disconnecting the exhaust hanger. The tailpipe should be free to move in all directions by applying minimal force. If the tailpipe isn't free to move:

7.4.1 - Disassemble the ball joints and inspect for surface abnormalities such as galling or wear marks.

7.4.2 - Rework the ball joints as required to correct noted discrepancies.

7.4.3 - Reassemble the ball joints. Do not over tighten the clamp as this may distort ball surfaces.

7.5 - All slip joints must be disassembled and lubricated with a high-temperature anti-seize compound. (Only necessary 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.

7.6 - Be sure to remove heat shroud to inspect within the collector assembly. If the integrity of any surface is suspect, proceed as follows:

If any defects 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:

7.6.1 - Remove shroud.

7.6.2 - Seal four of the openings (tubes) with rubber expansion plugs.

7.6.3 - Submerge the collector assembly in water.

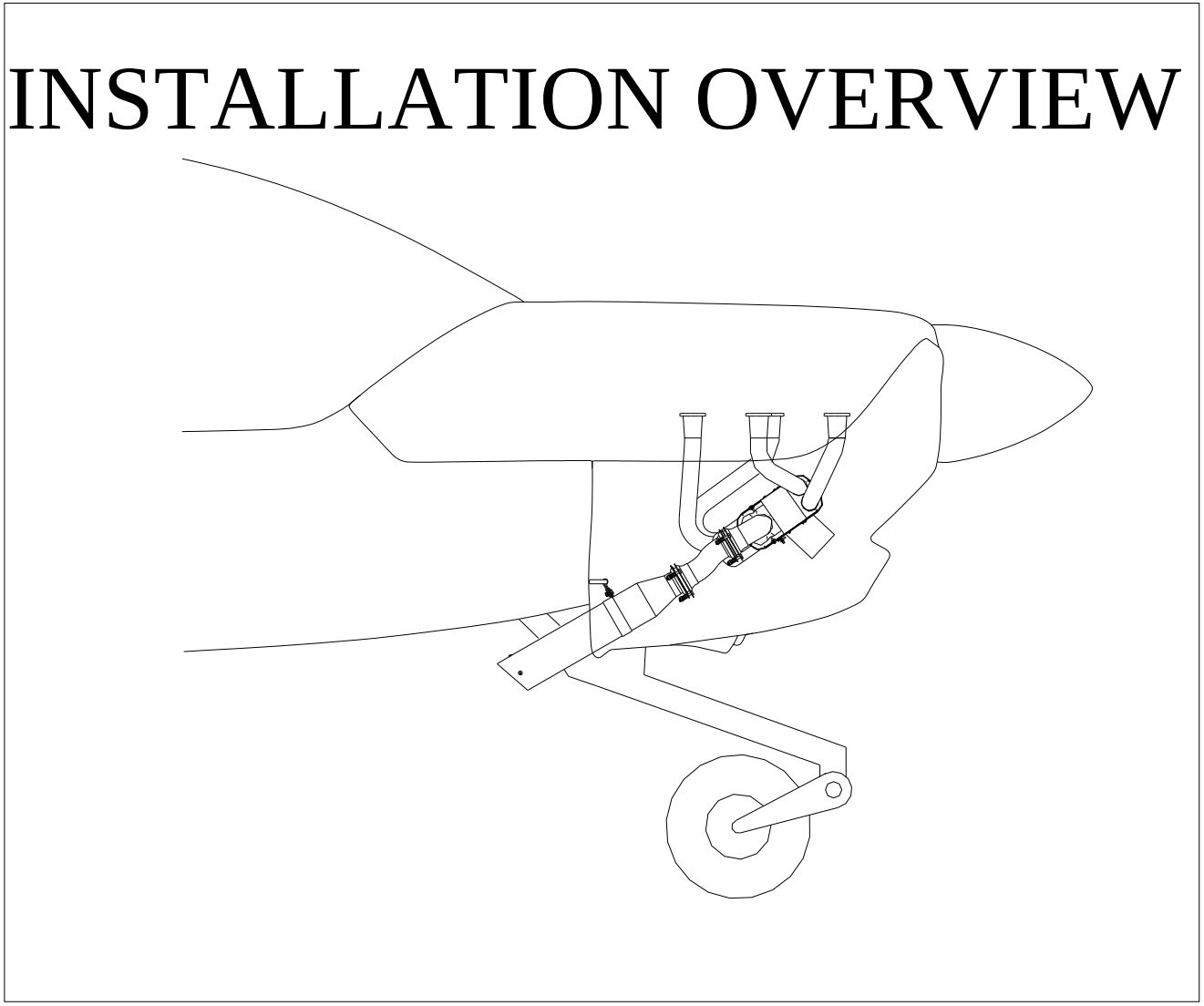
7.6.4 - Using a manometer or pressure gauge, apply 3.0 to 3.5 PSI (approximately 7” Hg) of air pressure to the fifth opening.

7.6.5 - Let the unit sit pressurized for 10 to 30 seconds. The leak rate should be zero.

7.6.6 - If a leak is found in the collector assembly, replace before further flight.

7.6.7 - If no leaks are found, dry components and install on airplane.

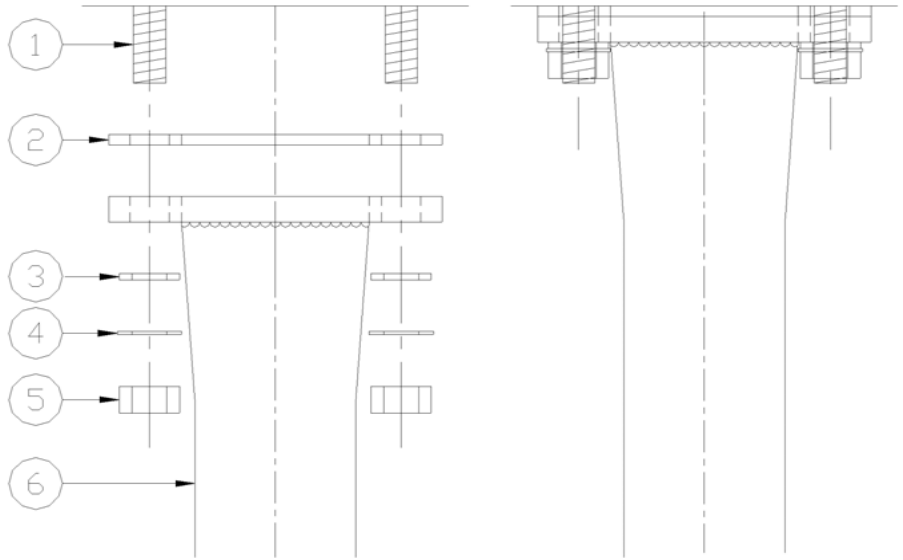
INSTALLATION OVERVIEW



DETAIL “A”

Detail "A"

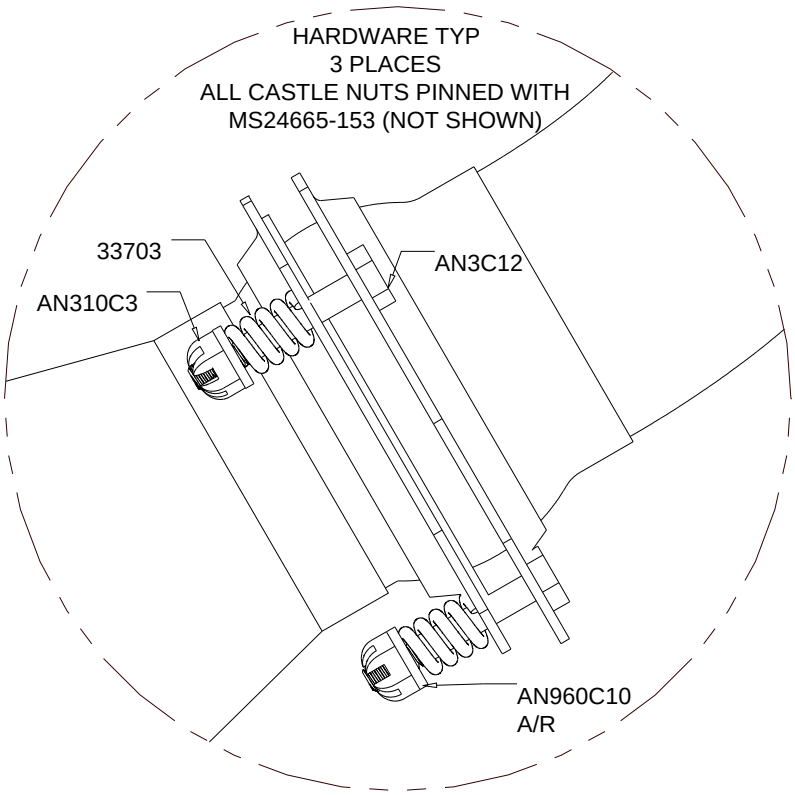
1	Exhaust Stud	Lycoming Engine
2	No-Blow Gasket	77611
3	Flat Washer	AN960-516
4	Lock Washer	MS35333-41
5	Nut	SL-STD-1410
6	Header	Various



Note: Equivalent Stainless Steel Hardware may be substituted.

STD-2233 NUTS AND STD-35 WASHERS MAY BE USED IN PLACE OF ITEMS 3, 4, AND 5.

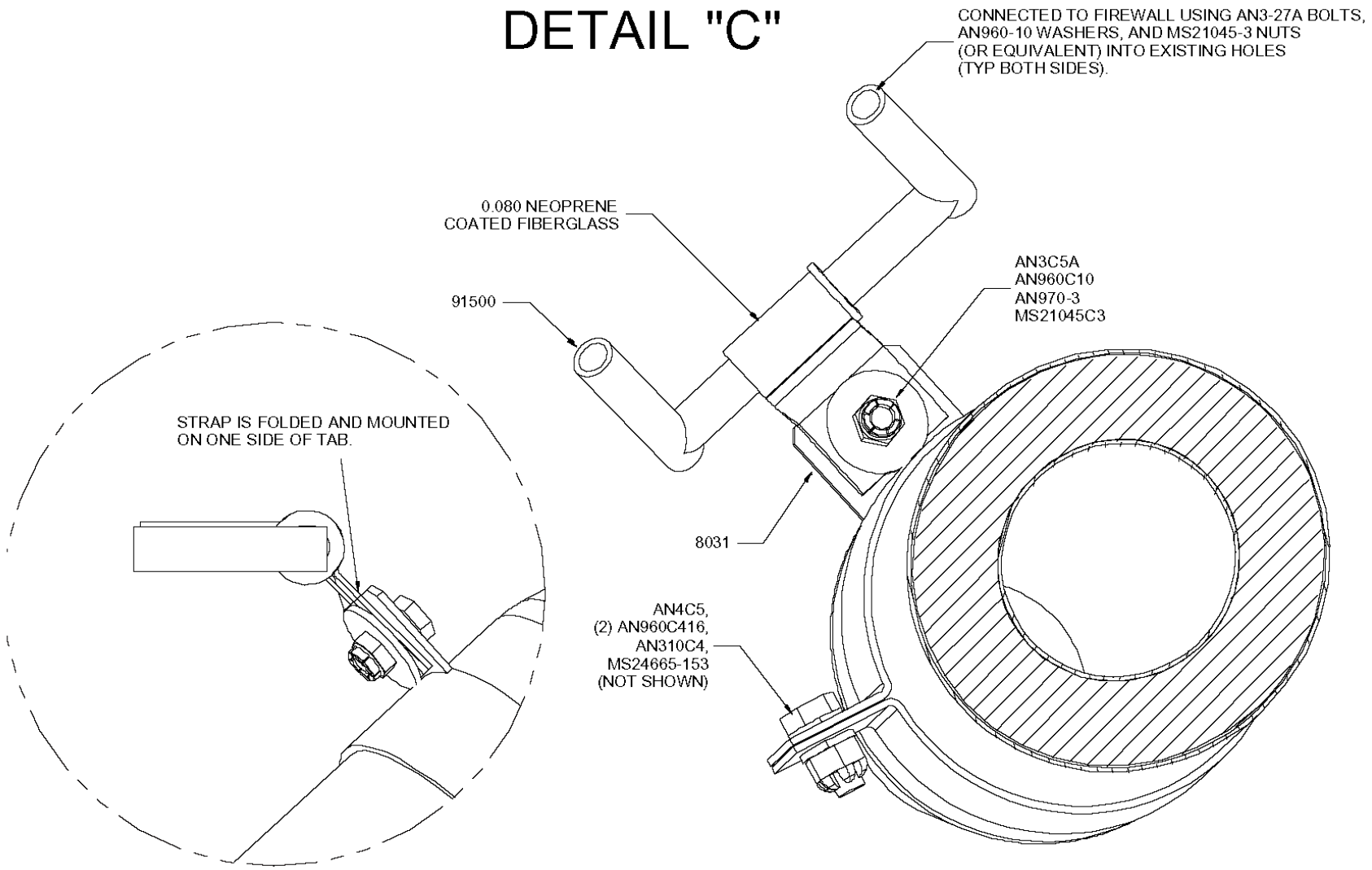
DETAIL B



COMPRESSED SPRING HEIGHT:
0.430 - 0.475
ADD OR SUBTRACT WASHERS AS
NECESSARY

DETAIL "B"

DETAIL “C”


DETAIL "C"
CONNECTED TO FIREWALL USING AN3-27A BOLTS, AN960-10 WASHERS, AND MS21045-3 NUTS (OR EQUIVALENT) INTO EXISTING HOLES (TYP BOTH SIDES).
0.080 NEOPRENE COATED FIBERGLASS
91500
AN3C5A
AN960C10
AN970-3
MS21045C3
STRAP IS FOLDED AND MOUNTED ON ONE SIDE OF TAB.
8031
AN4C5,
(2) AN960C416,
AN310C4,
MS24665-153
(NOT SHOWN)

PHOTOCOPY OF STC

United States of America
Department of Transportation -- Federal Aviation Administration

Supplemental Type Certificate

Number SA03281AT

This certificate issued to Power Flow Systems, Inc.
1585 Aviation Center Parkway
Hangar 804
Daytona Beach, FL 32114

Not Valid without written authorization from Power Flow Systems, Inc.

certifies that the change in the type design for the following product with the limitations and conditions therefor as specified hereon meets the airworthiness requirements of Part 23 of the Federal Aviation Regulations.

Original Product - Type Certificate Number: A47CE
Make: Diamond
Model: DA 40 ; DA 40 F

Description of Type Design Change: Install a Power Flow Systems, Inc. tuned exhaust system featuring new headers, new collector assembly and new tail pipe on the applicable airplane model per the matrix shown on Continuation Sheet, Page 3.

(See continuation sheet 3 of 3)

Limitations and Conditions: Instructions for Continued Airworthiness are part of this STC. "This approval should not be extended to other aircraft of this model on which other previously approved modifications are incorporated, unless it is determined by the installer that the interrelationship between this change and any other previously approved modifications will produce no adverse effect upon the airworthiness of that airplane. If the holder agrees to permit another person to use this certificate to alter the product, the holder shall give the other person written evidence of that permission."

This certificate and the supporting data which is the basis for approval shall remain in effect until surrendered, suspended, revoked or a termination date is otherwise established by the Administrator of the Federal Aviation Administration.

Date of application: March 30, 2006
Date of issuance: June 07, 2006

Date reissued:
Date amended:

By direction of the Administrator

Christina L. Marsh
(Signature)

for Melvin D. Taylor, Manager
Atlanta Aircraft Certification Office
(Title)

Any alteration of this certificate is punishable by a fine of not exceeding $1,000, or imprisonment not exceeding 3 years, or both.

This certificate may be transferred in accordance with FAR 21.47.

United States of America

Department of Transportation - Federal Aviation Administration

Supplemental Type Certificate

(Continuation Sheet)

Number SA03281AT

Date of Issuance: June 07, 2006

Description of Type Design Change (Continued):

Power Flow Systems, Inc. Improved performance exhaust system installation information

Model	Master Drawing List Report no. *	Installation Instructions & ICA Report No. * **
DA 40	PFS-15240-00, Rev. IR, Dated: 6/02/06	PFS-15250-00, Rev. IR, Dated: 4/17/06
DA 40 F	PFS-15140-00, Rev. IR, Dated: 3/30/06	PFS-15150-00, Rev. IR, Dated: 3/30/06

* Or later FAA approved revision

** Contains Instructions for Continued Airworthiness (ICA)

----------END----------