

REPORT NAME: KIT PFS-13202
INSTALLATION INSTRUCTIONS

REPORT NUMBER: PFS-0018-00

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PREPARED BY: Tom Strohmayer

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END USER

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DATE: 12/10/02
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Revision Control Page

REPORT PFS-0018-00 Kit PFS-13202

REVISION	DATE	REMOVE PAGES	INSERT PAGES
IR	06/08/00	N/A	N/A
A	09/21/00	1,2,4,14	1,2,4,14
B	02/12/01	1,2,4,8,9,13	1,2,4,8,9,13
C	09/14/01	1,2,3,4,5,6,7,8	1,2,3,4,5,6,7,8
D	01/01/02	1,2,5-9,11,13	1,2,5-9,11,13
E	02/26/02	1-5,9,15	1-5,9,15
F	08/30/02	1-9,12,14,16	1-9,12,14,16

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Introduction

Your exhaust muffler has been chemically polished to remove manufacturing marks and provide an attractive finish. The tubular components are manufactured from 321 Stainless Steel and can be further polished for an extremely high shine.

After installation and before running engine, we highly recommend wiping clean the exhaust muffler to remove all finger-prints, grease, and other contaminants with Alcohol, MEK, Lacquer thinner, or similar liquid degreaser.

After installation and cleaning exhaust muffler, run engine and let it warm up then run at full power for a short period. This will create a “Bluing” of the exhaust and a golden yellow color of the muffler.

To maintain this “Blued” finish keep exhaust free from oil, fingerprints, and any other contaminates by normal cleaning or polishing.

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 forward 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 detachable tailpipe from the collector assembly routes exhaust gases to a muffler through an opening in the lower cowling. A support rod attached to the lower right engine mount supports the muffler.

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

***Please read these directions 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.***

Carbon Monoxide testing was performed with the muffler positioned as described in these instructions. Repositioning the muffler and/or support rod may cause carbon monoxide to enter the aircraft cabin.

Weight and Balance Information

Typical Weight and Balance Information: The PFS System weighs between 3 and 5 pounds more at station 0.0 (the firewall). Since the exact weight of stock exhaust systems can vary, it is recommended that you weigh both the old exhaust system and the new exhaust system to obtain an exact weight differential.

Kit Contents

Each Power Flow exhaust kit is shipped with:

4 Headers	PN: 11100, 12100-O360, 13100, 14100-O360
4 No-blow Header Gasket	PN: 77611
8 Exhaust Nut	PN: SL-STD-1410
8 Lock Washer	PN: MS35333-41
8 Plain Washer	PN: AN960-516
1 Support Rod	PN: 90020
1 Adel Clamp size 6	PN: MS21919WH6
1 Adel Clamp size 12	PN: MS21919WH12
1 Locknut	PN: MS21044C3
1 Bolt	PN: MS51958-63
2 Flat Washer	PN: AN960C10
1 Muffler Clamp	PN: 8030
1 Shrouded Collector Assembly	PN: 41721(S)
1 Muffler Assembly	PN: 80010
1 Exhaust Clamp	PN: 7020
2 Drilled Bolt	PN: AN4C5
2 Castle Nut	PN: AN310C4
2 Cotter Pin	PN: MS24665-153
4 Flat Washer	PN: AN960C416

*Note: Your kit has been shipped with either a stainless steel or aluminum heat shroud.
PN 41721S indicates a stainless steel heat shroud. PN 41721 indicates an aluminum
heat shroud.*

PREPARATION

REMOVAL OF OLD EXHAUST SYSTEM

- 1) Remove engine cowling in accordance with the current Aircraft Service Manual.
- 2) Disconnect flexible ducts from muffler assembly and exhaust pipe.
- 3) Remove EGT probe(s), if installed.
- 4) Remove nuts, bolts, and clamps attaching exhaust pipes to muffler assembly.
- 5) Loosen nuts attaching exhaust pipes to cylinders and remove muffler assembly.
- 6) Remove exhaust pipes and gaskets.

NOTE: Our Carburetor heat adapter is designed to accept 2 common sizes of SCAT hose. If your hose is large (2.5" diameter), cut off and deburr the reducer portion of the adapter.

Verify that all contents listed on page 5 of this instruction set are included in your kit. Read all instructions before attempting installation, to become familiar with the procedure.

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.

A. Installing Collector Box Assembly and Exhaust Pipes:

- 1) Unscrew and remove the end piece from the shroud assembly (the part with the Identification Tag on it). Insert the #1 & # 3 exhaust header pipes into the collector assembly.

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

- 2) The header pipes must be installed at least 1 1/2" into the collector assembly (P/N 41721(S)). Align each header with the factory's alignment marks to ensure correct orientation and adequate installation depth. Remove the alignment labels. Re-secure the shroud end piece onto the collector unit. See Passenger Side View.
- 3) Put new 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 - ensure that the cabin heat inlet is positioned in the forward baffle.

Power Flow Systems, Inc. Extractor Exhaust Installation Instructions
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Installing Collector Box Assembly and Exhaust Pipes: (Continued)

- 4) Insert the #2 & #4 exhaust header pipes into the collector assembly. The header pipes must be installed at least 1 1/2" into the collector assembly (P/N 41721). Align each header with the factory's alignment marks to ensure correct orientation and adequate installation depth. Remove the alignment labels. Ensure that the #2 & #4 exhaust headers do not rub where they bend before entering the collector box. You can maneuver the headers to have a minimum .20" clearance between #2 & #4.
- 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." Torque the exhaust nuts to final torque after proper orientation and assembly position of the exhaust system is achieved. Use the torque recommended in the latest approved revision of either the Aircraft Service Manual or AC 43.13.
- 6) The correct angle of the PFS collector box is for the outlet tube to be oriented approximately 13 degrees from the vertical towards the tail. You can rotate the box by grasping the outlet and rotating. The exhaust headers have a slip fit, which allows for rotation. See Side Views.
- 7) Install all air ducts to the collector box shroud.

B. Installing Support Rod P/N 90020:

- 1) Examine the right lower engine mount bolt and nut. If you have one to two threads showing at the nut, it may be necessary to install the next dash number longer AN7 bolt after installing our support rod adapter. This bolt is NOT supplied with the kit.
 - a. Loosen and remove the lower right engine Lord mount bolt. Our support rod adapter (the teardrop shaped piece of metal welded to the support rod) goes under the bolt head, on top of the existing large area washer. Ensure that the rod clears all engine compartment parts, and will exit the cowl near the firewall, inboard of the engine mount and directly behind the exhaust pipe exiting the collector assembly. The end of the support rod should be inboard (approximately 2-3 inches) and forward of the lower right cowl mount. Also make sure that the pointed end of the support rod will clear the bottom of the aircraft cowl.
 - b) Tighten, but DO NOT TORQUE TO VALUE YET. You will fully torque the mount once the position and adjustment of the support rod is complete.
- 2) Secure the support rod to the engine tubular mount with supplied ADEL clamps. Position the smaller clamp approximately 2/3 of the way down the support rod. Position the larger ADEL clamp around the engine tubular mount that comes closest to the support rod. *The objective here is not to change the angle of the support rod, but just to help dampen any lateral motion that can occur.* Secure the ADEL clamps with the supplied hardware.

REFER TO INSTALLATION TEMPLATE - SUPPORT ROD COWLING HOLE LOCATION
The hole in cowling for support rod may not be needed. If the template does not fit as drawn, no hole is to be drilled.

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Installing Support Rod P/N 90020: (Continued)

- 3) The support rod will exit the cowl on the right side, inboard and forward of the bottom cowl mount hole. To locate the support rod hole, turn the bottom cowl over, and use the supplied template, mark and drill a 1.5 “ diameter hole. The edge of this hole should be .25” forward of the cowling support rib and 3.0” inboard of the lowest cowl mounting hole.
 - a. Temporarily install the lower cowl and check for correct positioning of the support rod. It should come through the hole in the cowl without touching the sides of the cowl. **Check that the outlet of the collector fits through the forward hole (where the old exhaust exited) with a minimum .25” clearance on all sides.** You can rotate the collector by gripping the outlet of the collector and rotating the entire collector to orient it in the cowl. The desired angle is approximately 13 degrees from the vertical.
 - b. Remove the cowl.
- 4) Slide the muffler assembly P/N 80010 over the collector outlet. It should be pushed up as far it can go, oriented straight back. The support rod should be contacting the unit at the muffler.
- 5) Get the large support clamp P/N 8030 and position it around the muffler so that it will be attached to the support rod with a bolt.
- 6) Position the clamp so that the holes in the clamp will align with the hole in the support rod.
- 7) Now that all of the support mechanism for the muffler is correct, tighten the engine mount to manufacturer’s specified torque.
 - *Be sure that the support rod doesn’t rotate when tightening.*
 - *Make sure that you have at least one to two threads showing through the nut on the engine mount. It may be necessary to install a longer bolt or remove one of the lower washers.*

Warning: Fuel strainer outlet must be redirected so that it does not spray fuel on tailpipe during fuel strainer drain operation.

C. Installing the Muffler:

Any deviation in muffler and/or support rod alignment may cause carbon monoxide to enter the aircraft cabin. The muffler must be pointed down and away from the aircraft—not parallel to the fuselage—in order to ensure that no exhaust gases enter the aircraft cabin.

- 1) Position the muffler so that it will be in the correct position for clamping to the support rod. Using the hole in the Muffler Assembly as a guide, drill a 9/32”, 17/64”, “F”, or 6.8mm to 7.2mm hole through the collector outlet so that the exhaust clamp P/N 7020 holds the upper portion of the muffler assembly onto the collector outlet. The fit of the pin into the hole should not be tight. **See Detail “B”.**

NOTE

The muffler and clamp are designed to be a loose fit to the 4 to 1 outlet.

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- 2) With the large clamp free from the support rod, the lower end of the muffler assembly should be able to 'wobble' 1/2" to 1 1/2" from side to side.
- 3) Remove muffler assembly to re-install the cowl.
- 4) Re-install the muffler. Secure the exhaust clamp [see notes below] with the pin (p/n 7020) using a supplied AN4C5, washers, nut and cotter pin. We suggest positioning the bolt head on the inboard side of the clamp with the nut on the outboard side (for ease of cotter pin installation and removal.) The fit of the pin into the hole should not be tight. See Detail "B".

With the large clamp free from the support rod, the lower end of the muffler assembly should be able to 'wobble' 1/2" to 1 1/2" from side to side.

This movement de-couples the vibrations from the upper part of the exhaust system from the vibrations of the lower part of the system

- 5) After verifying that the end of the muffler is free to "wobble" 1/2 to 1 1/2 inches from side to side, attach the muffler assembly to support rod with muffler clamp P/N 8030. See Detail "C". We suggest positioning the bolt head on the inboard side of the clamp with the nut on the outboard side (for ease of cotter pin installation and removal.)

Secure the clamp using a supplied AN4C5, washers, nut and cotter pin. DO NOT SEPARATE EITHER SIDE OF THE CLAMP WITH THE SUPPORT ROD.

The clamp ends must come together to correctly work. The support rod should be on whichever side of the clamp that seems to fit best.

The support rod should not be under any side-load at this point.

- 6) Make appropriate entries in the logbook and on a FAA Form 337. The STC is located at the back of this instruction set for easy removal.
 - Typical Weight and Balance Information: The PFS System weighs between 3 and 5 pounds more at station 0.0 (the firewall). Since the exact weight of stock exhaust systems can vary, it is recommended that you weigh both the old exhaust system and the new exhaust system to obtain an exact weight differential.

Please Note:

The Power Flow Systems, Inc. tuned exhaust system may cause the aircraft to burn more fuel at high power settings when running a rich mixture. It is the Pilot's responsibility to determine what, if any, change in fuel flow exists and to plan accordingly.

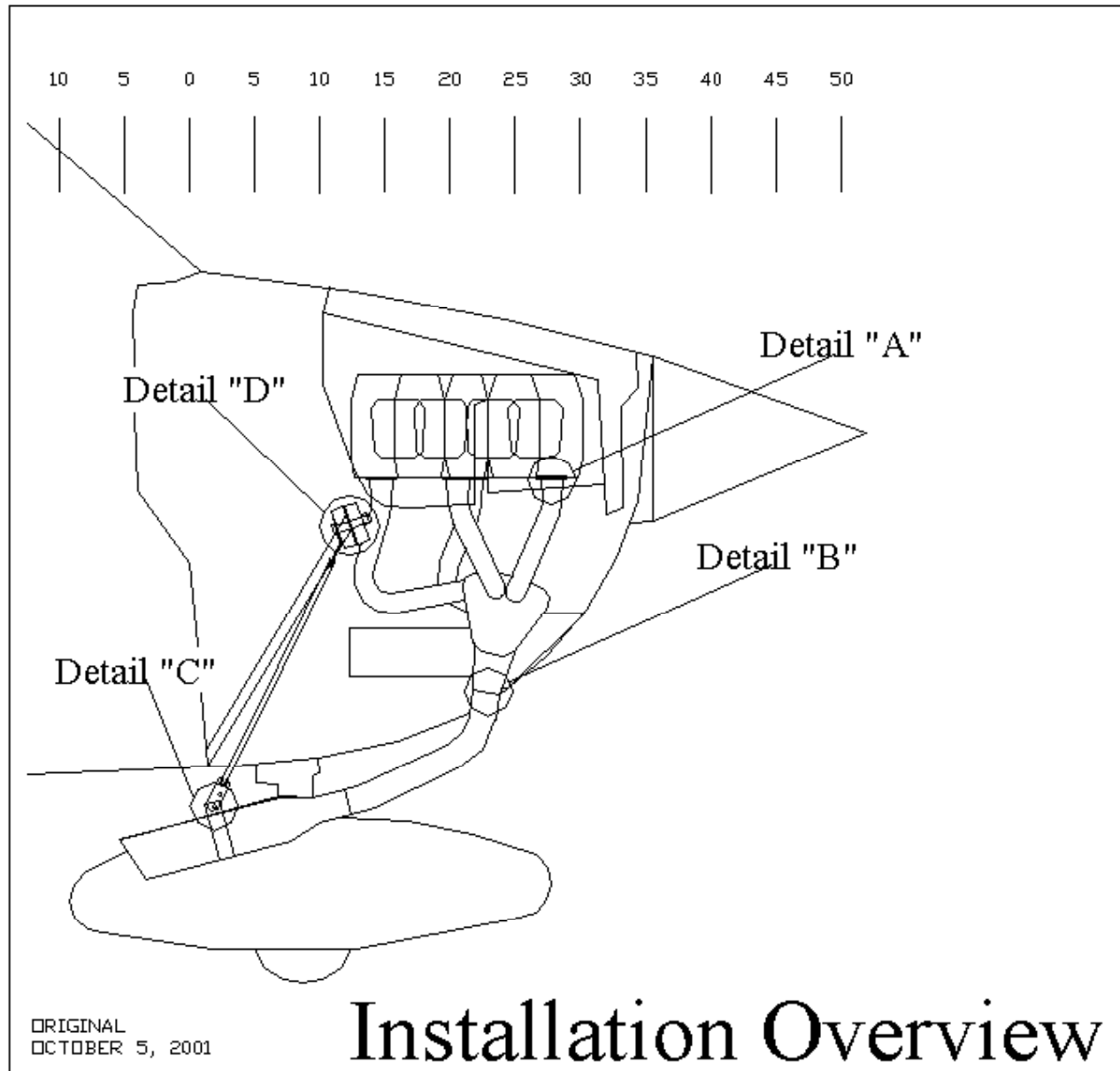
REMOVAL OF PFS EXHAUST SYSTEM

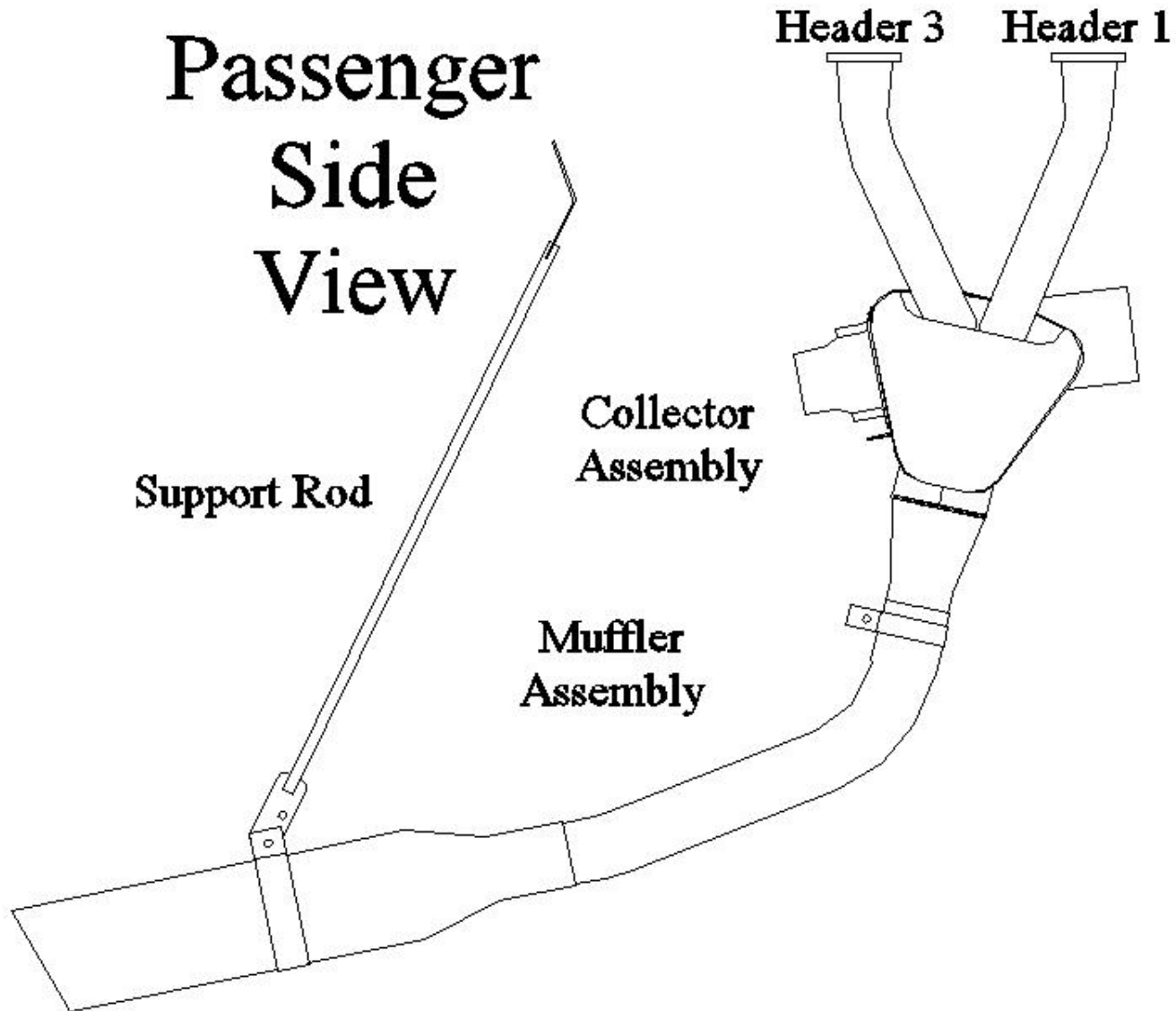
- A) Disconnect muffler support rod P/N 90020 from muffler clamp P/N 8030.
- B) Disconnect exhaust clamp P/N 7020 and remove muffler assembly P/N 80010 from collector assembly.
- C) Remove lower cowl as per the latest approved Aircraft Service Manual.
- D) Disconnect flexible ducts from collector assembly.
- E) Remove EGT probes if installed.
- F) Remove exhaust pipes from cylinders 2 & 4 and separate them from the collector assembly.
- G) Remove the collector assembly by pulling out from the 1 & 3 cylinder side.

INSPECTION

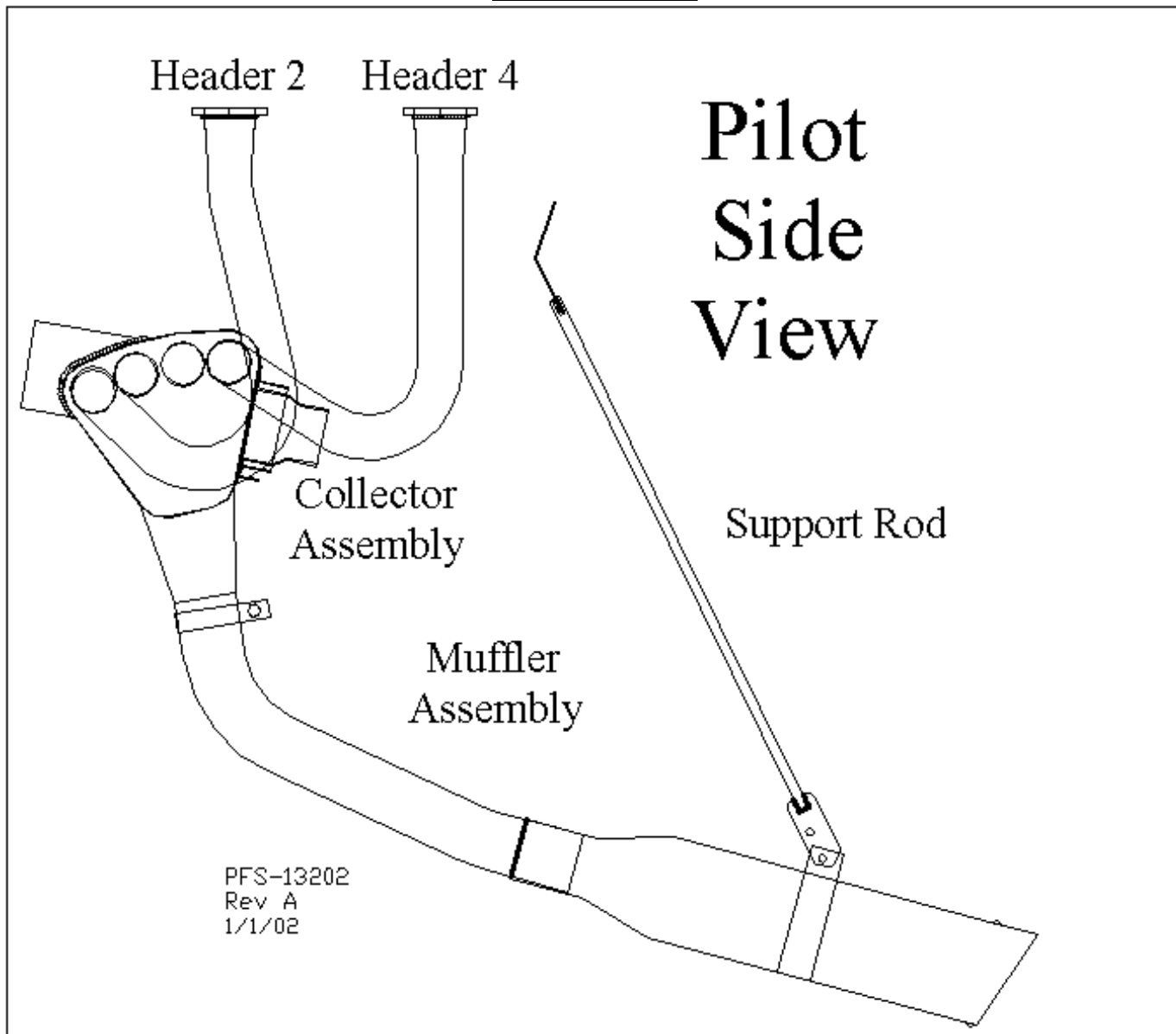
See accompanying report, PFS-0017-00 for Instructions for Continued Airworthiness.

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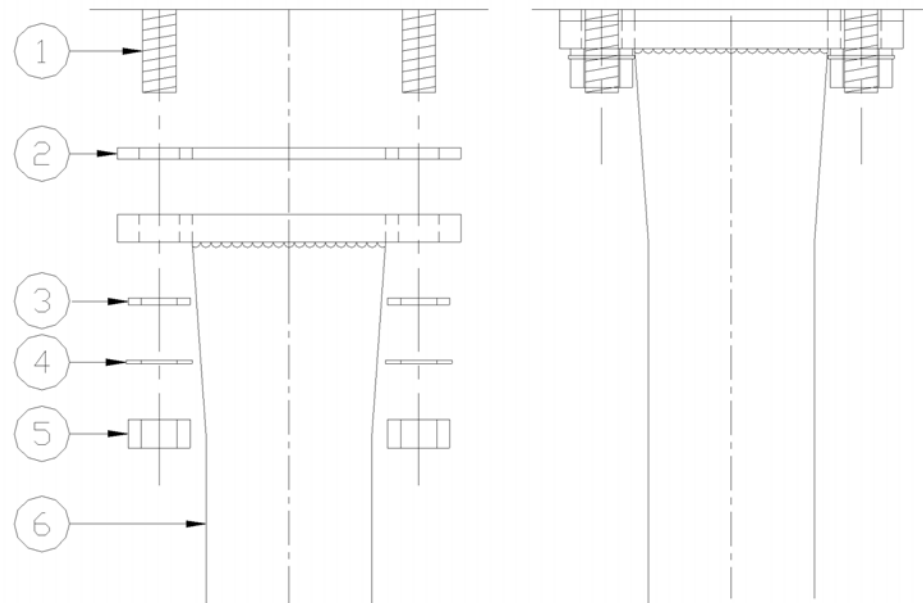


Power Flow Systems, Inc. Extractor Exhaust Installation Instructions
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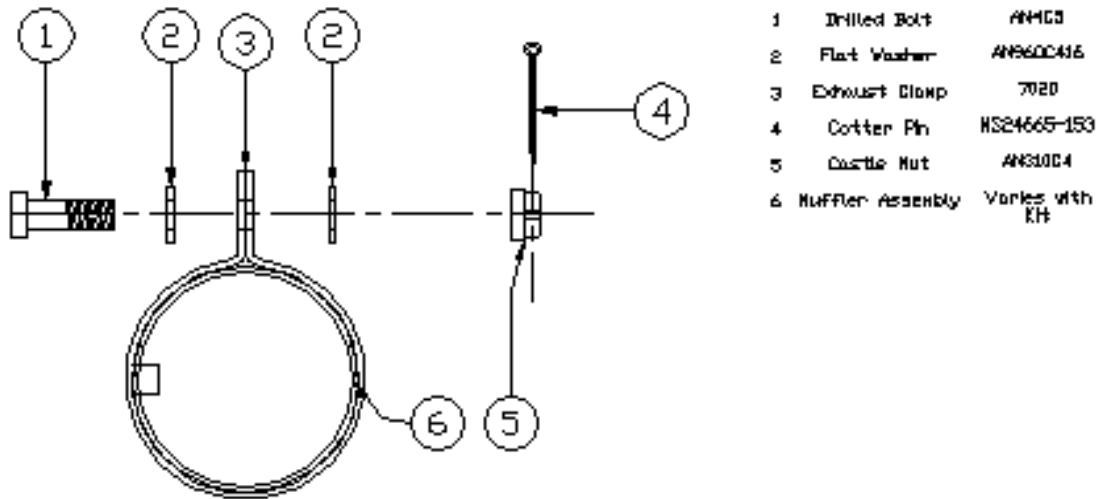
Detail "A"

- | | | |
|---|----------------|-----------------|
| 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 |



Rev A 06/05/02

Detail "B"



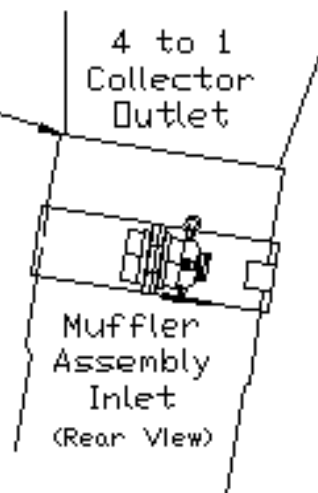
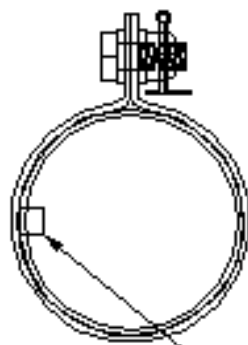
- | | | |
|---|------------------|-----------------|
| 1 | Drilled Bolt | AN403 |
| 2 | Flat Washer | AN960C416 |
| 3 | Exhaust Clamp | 7020 |
| 4 | Cotter Pin | NS24665-153 |
| 5 | Castle Nut | AN310C4 |
| 6 | Muffler Assembly | Varies with Kit |

NOTE:

The muffler and clamp are designed to be a loose fit to the 4 to 1 outlet. With the large clamp free from the support rod, the lower end of the muffler assembly should be able to 'wobble' 1/2" to 1 1/2" from side to side.

CAUTION

The muffler to 4-1 junction is designed to be loose.



NOTE:

The pin should **NOT** be a tight fit. The holes in the Muffler and the 4-to-1 Collector should be drilled with a size 17/64", 6.8 to 7.2mm, "F", or 9/32" drill bit.

Revision C
 February 26, 2002

Power Flow Systems, Inc. Extractor Exhaust Installation Instructions
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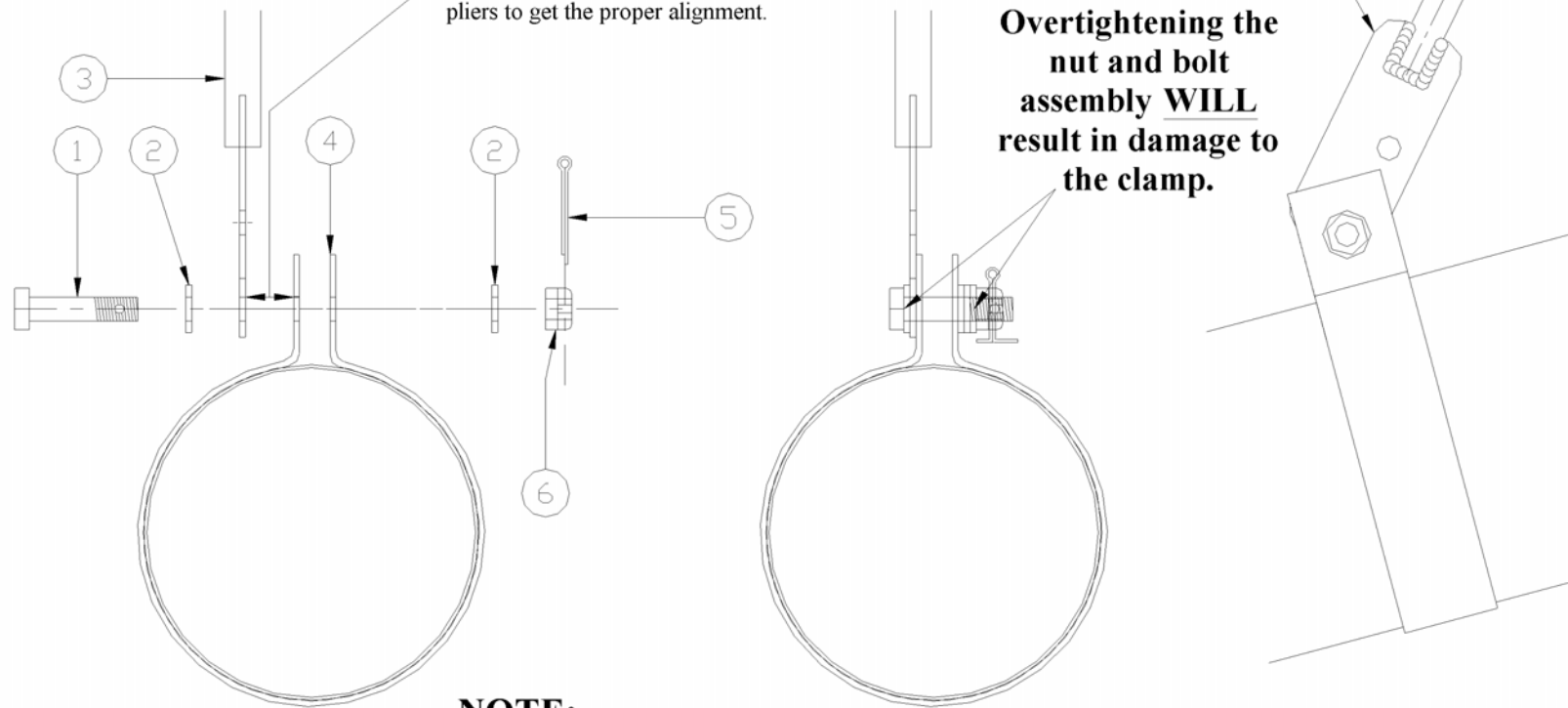
Detail "C"

- 1 Drilled Bolt AN4C5
- 2 Flat Washer AN960C416
- 3 Support Rod Varies with Kit
- 4 Muffler Clamp 8030
- 5 Cotter Pin MS24665-153
- 6 Castle Nut AN310C4

NOTE:
The tab should sit flat against the side of the clamp. If necessary, twist the end tab with pliers to get the proper alignment.

CAUTION
Overtightening the nut and bolt assembly WILL result in damage to the clamp.

ROD END MAY DIFFER IN APPEARANCE.



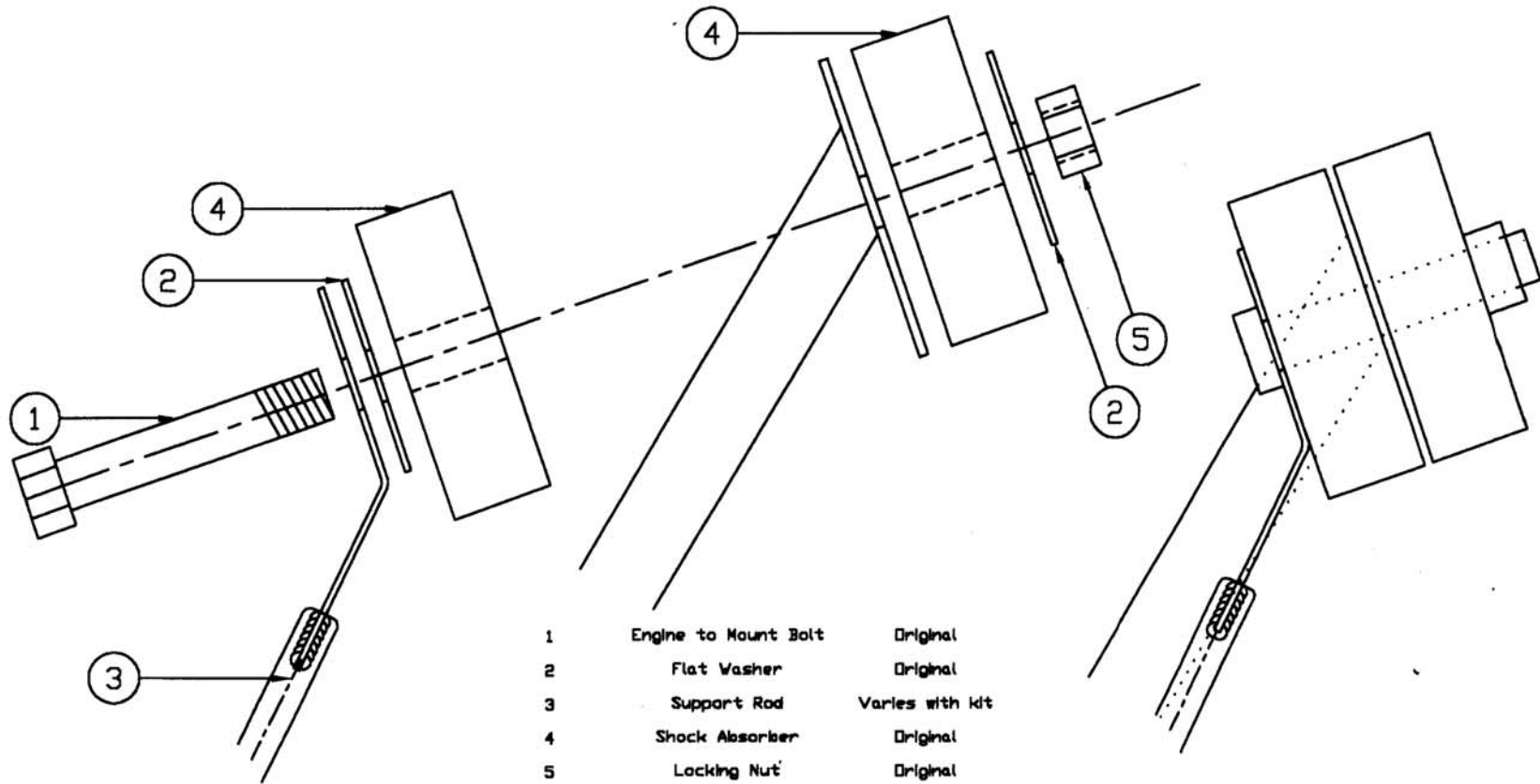
NOTE:

The muffler is designed to be a loose fit to the 4 to 1 outlet.

With this clamp free from the support rod, the lower end of the muffler assembly should be able to 'wobble' at least 1/2" to 1 1/2" from side to side.

Revision C
August 30, 2002

Detail "D"



Original June 7, 2000

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

Supplemental Type Certificate

Number SA02228AT

This STC is not valid without a letter of authorization for a specific aircraft registration number from Power Flow Systems, Inc.

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

certifies that the change in the type design for the following product with the limitations and conditions thereof as specified hereon meets the airworthiness requirements of Part 3 of the Civil Air Regulations.

Original Product - Type Certificate Number: 3A12
Make: Cessna
Model: 172, 172A-I; 172 K-N; 172P

Description of Type Design Change:

For the Cessna 172 airplane models incorporating Lycoming O-360 engines per STC SA332GL, STC SA4428SW or STC SA703GL: Modification of the standard exhaust system as documented in Power Flow Systems, Inc. Installation Instructions PFS-13202, Revision A dated September 21, 2000 and Master Drawing List, Report No. PFS-0022-00, Revision IR dated July 20, 2000 or later FAA Approved Revisions.

For the Cessna 172 airplane models incorporating Lycoming O-360 engines per STC SA647CE, STC SA1324CE or STC SA807CE: Modification of the standard exhaust system as documented in Power Flow Systems, Inc. Installation Instructions PFS-13203, Revision A dated September 21, 2000 and Master Drawing List, Report No. PFS-0023-00, Revision IR dated July 20, 2000 or later FAA Approved Revisions.

Limitations and Conditions: Airplane Flight Manual Supplement is not required with 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: July 20, 2000

Date reissued:

Date of issuance: October 17, 2000

Date amended: January 16, 2001



By direction of the Administrator

Janey Robertello
(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.