



*Installation Instructions and  
Instructions for Continued Airworthiness  
Kit: PFS-14150/14151*

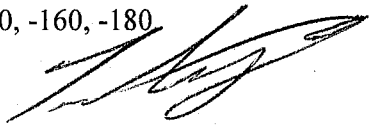
REPORT NAME: PFS-14150 / PFS-14151 Tuned Exhaust System Installation  
Instructions and Instructions for Continued Airworthiness

REPORT NUMBER: PFS-14250-00

REVISION: H

REPORT DATE: February 11, 2011

AIRCRAFT APPLICABILITY: Piper PA28-140, -150, -160, -180

PREPARED BY: T. STROHMAYER 

DISTRIBUTION: FAA ATL ACO, FAA MKC AEG, END USER

STC NUMBER: SA02168AT


**Revision History**

REVISION	DATE	REMOVE PAGES	INSERT PAGES
IR	JAN/22/2003	N/A	N/A
A	JAN/28/2003	5, 19	5, 19
B	JUN/11/2003	4-8, 10-14, 17, 20	4-8, 10-14, 17, 20
C	AUG/19/2003	4,6-12	4,6-12
D	OCT/01/2003	4-6,8,9,11-17, 20	4-6,8,9,11-17, 20
E	JUL/02/2004	1,3-5,8,10,12,13,16	1,3-5,8,10,12,13,16
F	JAN/21/2005	1,3-10	1,3-10
G	MAY/22/2007	2-4, 6-8, 10, 11	2-4, 6-8, 10, 11
H	FEB/11/2011	ALL	ALL

**Revision Notes:**

**Rev H:** Updated Format. Changed all anti-seize references to reference specific minimum standard. Added EGT probe instructions. Updated hardware. Expanded section on Removal. Incorporated short stack tailpipe addendum. Corrected W&B. Added SCAT hose routing details.

**Approval Notes:**

 Sections 4.0 and 6.2 are FAA Approved.

F. A. A.  
**APPROVED** 

ATLANTA AIRCRAFT CERTIFICATION  
OFFICE CENTRAL REGION

BY: 

DATE: 5-9-2011



**TABLE of CONTENTS**

1.0 INTRODUCTION ..... 3

2.0 PREPARATION ..... 3

3.0 Kit Contents ..... 4

    3.1 Classic Tailpipes..... 4

    3.2 Short Stack Tailpipes..... 5

    3.3 SCAT Hoses ..... 6

4.0 INSTALLATION ..... 7

    4.1 Nosebowl Modification ..... 7

    4.2 Installing Collector Box assembly and Exhaust pipes..... 7

    4.3 Installing Support Rod (Applies to Classic Style Tailpipes Only) ..... 8

    4.4 Short Stack Tailpipe Installation ..... 10

    4.5 Modifying the Lower Cowling (Classic Style Tailpipes)..... 10

    4.6 Modifying the Lower Cowling (Short Stack Style Tailpipes) ..... 11

5.0 INSPECTION AND PAPERWORK ..... 12

    5.1 Oil, Fuel, and Electrical Lines ..... 12

    5.2 Placard ..... 12

    5.3 Records..... 12

6.0 INSTRUCTIONS FOR CONTINUED AIRWORTHINESS ..... 13

    6.1 Basic Operation ..... 13

    6.2 Airworthiness Limitations ..... 13

    6.3 Troubleshooting..... 14

    6.4 Maximizing Service Life ..... 15

    6.5 Removal ..... 15

    6.6 Inspection ..... 15

Installation Overview (Classic Tailpipe)..... 17

Installation Overview (Short Stack Tailpipe)..... 18

Pilot Side View (Classic Tailpipe) ..... 19

Passenger Side View (Classic Tailpipe)..... 20

Rear View (Classic Tailpipe) ..... 21

Detail A ..... 22

Detail B ..... 23

Detail C ..... 24

Detail D – Dynafocal Mounts ..... 25

Detail D – Conical Mounts..... 26

Detail E..... 27

Detail F..... 28

Detail G..... 29

Detail H..... 30

Detail I..... 31

## 1.0 INTRODUCTION

- PFS is the abbreviation for Power Flow Systems.
- Please read these instructions and the 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.
- 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.
- If your cowling has been modified at all to be different than when it was originally built, please ensure our modification will be compatible before installation or flying.

## 2.0 PREPARATION

Verify that all contents listed in section 3 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.

- Remove lower cowling in accordance with the latest approved revision of the Aircraft Service Manual. It is not necessary to remove the top cowl or nosebowl.
- Disconnect flexible ducts (SCAT hose) from muffler assembly.
- Cover carb heat inlet to prevent debris from entering the carburetor.
- Remove EGT probe(s), if installed.
- Remove all exhaust clamps.
- Remove nuts attaching exhaust pipes to exhaust studs.
- Remove exhaust pipes, muffler and exhaust gaskets.
- Inspect the carburetor air inlet connection on the back of the nosebowl. If the fiberglass flange is perpendicular to the rear face of the nosebowl, you must install the aluminum adapter flange P/N 6140 in accordance with section 4.1. If the fiberglass flange comes off the rear face of the nosebowl at an angle as shown in figure 2.1, you may skip section 4.1 and the aluminum adapter flange may be discarded.



Figure 2.1 - Angled Nosebowl Flange



### 3.0 Kit Contents

#### 3.1 Classic Tailpipes

Qty	Part Description	Part Number
1	#1 Header	11600
1	#2 Header	12600(-1)
1	#3 Header	13600
1	#4 Header	14600(-1)
4	No-blow Header Gaskets	77611
8	Exhaust Nuts	SL-STD-1410
8	Lock Washers	MS35333-41
8	Plain Washers	AN960-516
1	Shrouded Collector Assembly	41500
2	Exhaust Clamps (2" with pin)	7020
3	Stainless Bolts	AN4C5A
3	Stainless Lock Nuts	MS21045C4
6	Stainless Washers	AN960C416
1	Intermediate Tube	78102
1	Muffler (Tailpipe) Assembly	80010 (-CER) or 80140 (-CER)
1	Support Rod	90140 or 90151 (conical engine mounts)
1	Muffler (Tailpipe) Clamp	8030
1	#6 Cushion Clamp	MS21919WH6
1	#12 Cushion Clamp	MS21919WH12
1	Stainless Screw	MS51958-63
2	Stainless Washers	AN960C10
1	Stainless Lock Nut	MS21045C3
1	Nosebowl Flange	6140
6	Stainless Screws	MS51958-64
6	Stainless Lock Nuts	MS21045C3
12	Stainless Washers	AN960C10
12"	Self-adhesive Neoprene gasket	8694K16
1	2 to 3" Adapter w/ Hose Clamps	6583 (For aircraft with 2" Cabin Air Inlet)
1	Flow Divider	6584
1	45 Degree Fuel Fitting	MS20823-5 (PA28-150, -160, -180 Only)



### 3.2 Short Stack Tailpipes

Qty	Part Description	Part Number
1	#1 Header	11600
1	#2 Header	12600(-1)
1	#3 Header	13600
1	#4 Header	14600(-1)
4	No-blow Header Gasket	77611
8	Exhaust Nuts	SL-STD-1410
8	Lock Washers	MS35333-41
8	Plain Washers	AN960-516
1	Shrouded Collector Assembly	41500
1	Exhaust Clamp (2" with pin)	7020
1	Stainless Bolt	AN4C5A
2	Stainless Lock Nuts	MS21045C4
3	Stainless Washers	AN960C416
3	Stainless Drilled Bolts	AN3C12
3	Balljoint Springs	33703
3	Stainless Castle Nuts	AN310C3
3	Stainless Cotter Pins	MS24665-153
1	Intermediate Tube	78103
1	Male Balljoint Flange	510
1	Muffler (Tailpipe) Assembly	80060 (-CER)
2	Aluminum Strap Brackets	203
2	6"x1" Strap Material	210
2	#12 Cushion Clamps	MS21919WH12
2	Stainless Screws	MS51958-63
1	Stainless Bolt	AN3C4A
21	Stainless Washers	AN960C10
9	Stainless Lock Nuts	MS21045C3
1	Muffler (Tailpipe) Clamp	8030
1	Stainless Bolt	AN4C6A
1	Large Area Washer	AN970-4
1	Nosebowl Flange	6140
6	Stainless Screws	MS51958-64
12"	Self-adhesive Neoprene gasket	8694K16
1	2 to 3" Adapter w/ Hose Clamps	6583 (For aircraft with 2" Cabin Air Inlet)
1	Flow Divider	6584
1	45 Degree Fuel Fitting	MS20823-5 (PA28-150, -160, -180 Only)



### **3.3 SCAT Hoses**

**Aircraft with 3" Cabin Heat Air Inlet\*\* Tubes will receive:**

36" of SCAT-4 For Each Defroster Vent  
30" of SCAT-8 For Cabin Heat  
28" of SCAT-12 For Carb Heat  
57" of SCAT-12 For Intake Air  
30" of SCAT-10 For Exhaust Heat Outlet

**Aircraft with 2" Cabin Heat Air Inlet\*\* Tubes will receive:**

36" of SCAT-4 For Each Defroster Vent  
30" of SCAT-8 for Cabin Heat  
28" of SCAT-12 for Carb Heat  
30" of SCAT-8 for Intake Air (2" Side)  
28" of SCAT-12 for Intake Air (3" Side)  
30" of SCAT-10 For Exhaust Heat Outlet

\*\*The cabin heat air inlet described above is the SCAT line that runs from the engine baffling to the cabin heat section of the exhaust heat shroud. Two inch tubes always come from behind the #4 cylinder (Detail I), three inch tubes always come from behind the #3 cylinder (Detail H). If your aircraft has a 3" Air Inlet Tube, you will not receive P/N 6583 because it is not required for your installation.

Equivalent hardware may be used throughout.



## **4.0 INSTALLATION**

### **4.1 Nosebowl Modification**

If the fiberglass flange behind the air filter is attached to the back of the nosebowl at a downward angle as shown in figure 2.1, skip to section 4.2.

- 4.1.1 Using a cutoff wheel or hand saw, cut off the circular flange portion of the backside of the nosebowl and sand surrounding surface flat.
- 4.1.2 Align nosebowl extension (P/N 6140) over hole, with the flat edge up against the pilot side of the aluminum stiffener. Move the flange as far down as possible without decreasing the intake area. The flange will lie on some existing rivets in fiberglass.
- 4.1.3 Drill out these rivets and transfer hole locations to flange and cleco the flange in place. Mark the perimeter of the opening in the fiberglass on the forward face of the flange through the forward side of the nosebowl inlet.
- 4.1.4 Adhere the provided neoprene gasket to the mating side of the flange around the outside edge of the mark.
- 4.1.5 Cleco flange back into position. Drill and de-burr flange perimeter and install with the provided hardware (MS51958-64, AN960C10 and MS21045C3). Additional holes and hardware may be necessary. Be careful not to locate holes so fasteners interfere with flange or air filter gaskets.

### **4.2 Installing Collector Box assembly and Exhaust pipes**

- 4.2.1 Header slip joints come lubricated from the factory; if reinstalling the exhaust system, lubricate the header slip joints with high temperature anti-seize meeting or exceeding MIL-A-907E. Nickel based anti-seize is recommended.
- 4.2.2 Insert the exhaust header pipes into the collector assembly as per the numbering on the collector. Be sure to use the alignment marks. A minimum of 1 1/2" penetration is required for proper operation. If alignment marks do not exist, insert pipes approximately 1.6 inches and set the collector assembly to a 30 degree angle with respect to the crankshaft centerline. See Passenger and Pilot Side Views.
- 4.2.3 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.
- 4.2.4 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. Torque I.A.W. the latest revision of the aircraft or engine service manual. See Detail A and Pilot Side View.



*Installation Instructions and  
Instructions for Continued Airworthiness  
Kit: PFS-14150/14151*

- 4.2.5 Attach the intake SCAT tube from the nosebowl outlet to the carburetor. Attach the lower cowling with enough fasteners to obtain the proper nosebowl position. Using an inspection mirror if necessary, check the clearance between the nosebowl/SCAT tube and the collector assembly. A minimum clearance of ¼" should exist. The aluminum stiffener on the back of the nosebowl may be trimmed slightly if necessary, and/or the stainless heat shroud may be dimpled slightly as long as the shroud does not contact the tubes beneath it.
- 4.2.6 Connect the supplied SCAT tubes as shown in Pilot, Passenger, and Rear Views, as well as details H and I. On aircraft equipped with 3" air inlets (Detail H), the cabin heat air inlet tube routes behind the engine mount (be sure to keep clear of all moving cables and assemblies). If the aircraft has a 2" air inlet (Detail I), then the 6583 adapter may be used to transition from the 2" to 3" SCAT tubing. If the aircraft is equipped with a single defroster, cap one of the defroster outlets on P/N 6584 using a non-flammable material and hose clamp (we recommend a piece of SCAT material). Secure P/N 6584 to the engine mount to prevent excessive motion.
- 4.2.7 Install EGT Probes (if applicable) in accordance with the manufacturer's recommendations. All probes should be the same distance from the port, typically 2-4 inches. Be sure to angle the probe forward or aft. If the probe is installed pointed directly outboard, it may contact the engine cowling.

### **4.3 Installing Support Rod (Applies to Classic Style Tailpipes Only)**

- 4.3.1 Examine the right lower engine mount bolt and nut (the one on the engine, not the firewall). If you only have one to two threads showing at the nut, it may be necessary to omit the existing large area washer when reinstalling the bolt. See Detail D.
- 4.3.2 Loosen and remove the lower right engine Lord mount bolt. The teardrop shaped tab at the end of the support rod goes under the bolt head, on top of the existing large area washer (if the bolt is too short, omit the existing large area washer). See Detail D. Ensure that the rod clears all engine compartment parts and will exit the cowl directly behind the intermediate tube outlet, inboard and aft of the engine mount tubes. Also make sure that the pointed end of the support rod will clear the bottom of the aircraft cowl. If your aircraft has conical engine mounts, the support rod will attach to the forward side of the mount. See Figure 4.1.





Figure 4.1 – Support Rod Routing

- 4.3.3 Tighten the Lord mount bolt, but **DO NOT TORQUE TO VALUE YET**. You will fully torque the mount once the position and adjustment of the support rod is complete.
- 4.3.4 Install the intermediate tube (P/N 78102) over the 4-1 outlet of the collector assembly. Make sure it is pushed in all the way to the bottom of the flare. The bottom of the tube should point straight down.
- 4.3.5 Slide the muffler (tailpipe) over the intermediate tube outlet. It should be pushed up as far it can go, oriented straight back (neither left nor right) and slightly down. The support rod should be contacting the top of the tailpipe. You may have to make minor adjustments in alignment and rotation of both the muffler assembly and the intermediate tube. Again, be sure the intermediate tube is slid as far onto the 4-1 outlet as it will go.
- 4.3.6 Any deviation in tailpipe and/or support rod alignment may cause carbon monoxide to enter the aircraft cabin. The muffler must be pointed slightly down—not parallel to the fuselage floor—in order to ensure that no exhaust gases enter the aircraft cabin.
- 4.3.7 Position the large clamp, P/N 8030, around the tailpipe body and attach it to the support rod with an AN4C5A bolt, washers, and lock nut.
- 4.3.8 If your airplane has a nose wheel pant, turn the nose gear fully to the left and ensure that the muffler assembly does **NOT** strike the pant. If needed, rotate the muffler outward slightly. The support rod can be carefully bent to assist in assuring that the support rod and muffler clamp stay in alignment. If the end tab does not align flat against the clamp, twist the tab with pliers until it lays flat.
- 4.3.9 Drill and de-burr a 0.25” hole through the pilot hole in the upstream end of the muffler (tailpipe), and drill and de-burr another 0.25” hole through the intermediate tube flare and 4-1 collector, about 1 inch from the edge of the flare.

- 4.3.10 Install the pinned clamps. See Detail B. If the pins do not press easily into the holes, the holes should be reamed until the pins insert with moderate hand pressure.
- 4.3.11 Using the provided cushion clamps and hardware, secure the support rod to the engine mount about 2/3 of the way down the length of the rod. The purpose of these clamps is only to dampen side-to-side motion and provide separation between the support rod and the engine mount. See figure 4.1.
- 4.3.12 Remove the tailpipe, leaving the intermediate tube in place.

#### **4.4 Short Stack Tailpipe Installation**

Skip this section for classic style tailpipes.

- 4.4.1 Slide the balljoint flange P/N 510 over the intermediate tube, P/N 78103.
- 4.4.2 Install the intermediate tube (P/N 78103) over the 4-1 outlet of the collector assembly. Make sure it is pushed in all the way to the bottom of the flare. The ball end of the tube should point aft and slightly downward.
- 4.4.3 Assemble the balljoint by connecting the balljoint flange on the intermediate tube to the balljoint flange on the tailpipe (see Detail F). The tailpipe should align beneath two tubes that are part of the tubular engine mount. These engine mount tubes join at the lower passenger side firewall attach point. Make sure not to over-tighten the balljoint, as freedom of movement is critical to prevent cracking. Compressed spring height should be between 0.430 and 0.475”.
- 4.4.4 Install the cushion clamps and strap bracket P/N 203 (see Detail G) on the two engine mount tubes.
- 4.4.5 Place clamp P/N 8030 over the tailpipe and trim the straps (P/N 210) to length (the tailpipe will be at the proper angle when it passes about 4 inches below the firewall, pointed straight aft and slightly downward).
- 4.4.6 Finish assembly of the hanger (see Detail G).
- 4.4.7 Ensure that the balljoint assembly is straight and drill a 0.25” hole through the pilot hole in the flared end of P/N 78103 and the 4-1 outlet.
- 4.4.8 Install clamp P/N 7020 using AN4C5A Bolt, Washers, and locknut. The pin in the clamp should insert in the hole with moderate hand pressure. If the pin is difficult to insert, the hole may need further reaming. See Detail B.

#### **4.5 Modifying the Lower Cowling (Classic Style Tailpipes)**

Skip to Section 4.6 for Short Stack Tailpipes.

- 4.5.1 Stand the cowl on its rear edge, on a padded flat surface, and secure it to prevent it from falling.
- 4.5.2 Securely tape the template labeled “Exhaust hole template” on the cowl, lining up the holes as indicated. These holes are from the passenger edge of the cowl. This template is to be used as a guide only, and does not necessarily represent the final size and/or location of the cutout. See figures 4.2 and 4.3.

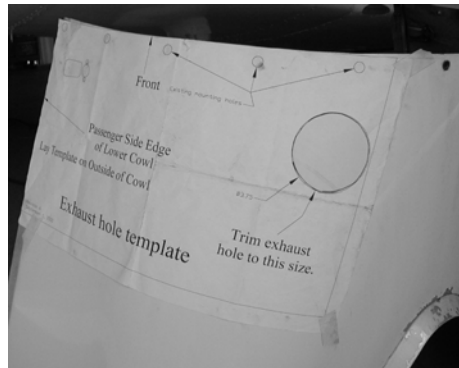


Figure 4.2

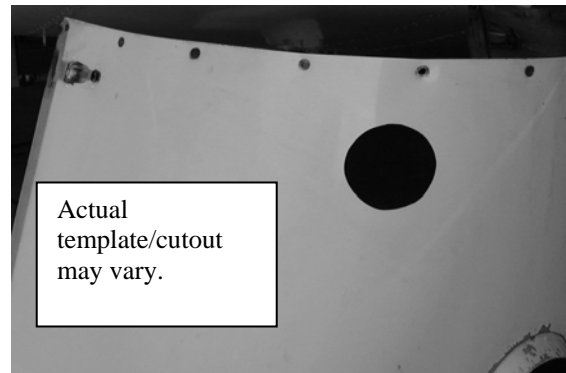


Figure 4.3

- 4.5.3 Cut out the small hole first and test fit the cowling using enough fasteners to ensure proper cowling positioning.
- 4.5.4 The intermediate tube may not clear the hole, however the purpose of this test fit is to determine if the center of the hole needs to move before the final 3.75" hole is cut. Adjust as necessary to maintain 0.25" minimum clearance on all sides of the intermediate pipe. Fit test as many times as necessary to avoid improper locating of the hole.
- 4.5.5 Now that all of the support mechanism for the tailpipe 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 two threads showing through the nut on the engine mount (lock-nut installation only). For castle nut installations, be sure to use a long enough bolt to allow insertion of a new cotter pin (not provided).

#### **4.6 Modifying the Lower Cowling (Short Stack Style Tailpipes)**

Skip to Section 5.0 for Classic Style Tailpipes.

- 4.6.1 Using two or three fixed reference points on the airframe, note the location of the tailpipe with respect to where the lower cowling would be.
- 4.6.2 Using the provided template and the reference dimensions obtained in the previous step, cut an outlet hole in the lower cowling. Please note that the template is for reference only. Since all aircraft vary slightly, the installer is responsible for cutting the hole in the correct location. **MEASURE TWICE, CUT ONCE!**
- 4.6.3 There should be between 0.5" and 1.0" of clearance around the tailpipe. Trim and fit the cowling as many times as necessary to obtain this clearance.



## **5.0 INSPECTION AND PAPERWORK**

### **5.1 Oil, Fuel, and Electrical Lines**

- 5.1.1 Be sure that the final 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.
- 5.1.2 A minimum of 2” clearance is required between oil/fuel lines and exhaust system tubes. We recommend routing the inboard line inside the intake runner tubes. The second (outboard) line may be Adel clamped to the rocker arm cover and/or one of the lower cowling to nose cowl fasteners. The fittings on the oil cooler may need replacement to achieve proper routing. Also, reroute fuel lines as necessary to maintain a minimum 2” of clearance to exhaust system components. For PA28-150, 160, and 180 aircraft with fuel pumps attached to their engine mounts, we have included a 45-degree fuel fitting that may help solve possible routing problems.
- 5.1.3 After installing the cowling and performing run-up, inspect the tailpipe and cowling for rubbing or chafing. The hole that the tailpipe passes through may need to be enlarged based on the amount of motion caused by engine start and shutdown. The motion of the tailpipe will be greatest during engine start and shutdown. Excessive motion could be an indication of worn engine Lord mounts.

### **5.2 Placard**

Supplied with your original installation kit is a placard that reads as follows. Install this in clear view of the pilot.

“The Power Flow Systems, Inc. tuned exhaust system installed on this aircraft may cause the aircraft to burn more fuel at certain power/mixture settings. It is the Pilot’s responsibility to determine what, if any, change in fuel flow exists and to plan accordingly.”

### **5.3 Records**

- 5.3.1 Make appropriate entries in the logbook and on FAA Form 337. The installation of this STC is considered a major AIRFRAME alteration. The STC is located at the back of this instruction set.
- 5.3.2 The Power Flow Systems, Inc. tuned exhaust system with the short stack tailpipe weighs 21.8 lbs at station 28. The Power Flow Systems, Inc. tuned exhaust system with the classic tailpipe weighs 23.0 lbs at station 28. A stock exhaust system weighed by Power Flow Systems, Inc. was 23.5 lbs at station 28. To be most accurate, it is recommended that you weigh both the old exhaust system and the new exhaust system to obtain an exact weight differential.



## 6.0 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 be obtained by calling Power Flow Systems, Inc. at (386) 253-8833 or online at [www.powerflowsystems.com](http://www.powerflowsystems.com)

### 6.1 Basic Operation

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

### 6.2 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.

- 6.2.1 Mandatory Replacement Time – None. Any collector assembly that is damaged and/or fails the pressure test described below must be replaced.
- 6.2.2 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.**
- 6.2.3 All slip joints must be disassembled and lubricated with a high-temperature anti-seize compound (MIL-A-907E or equivalent, do not use penetrating oil or solvent) at Annual intervals (within the preceding 12 calendar months). While disassembled, inspect for wear or galling. This shall be performed more frequently if headers seize between inspections.
- 6.2.4 Structural Inspection Procedure – See Section 6.6 Below.



### 6.3 Troubleshooting

<b>Problem</b>	<b>Possible Cause</b>	<b>Solution</b>
Exhaust smell or carbon monoxide in cockpit	Exhaust Leak, opening in firewall or fuselage	Immediately inspect exhaust system for leaks, <b>do not return to service until problem is resolved.</b>
Excessive noise	Muffler insert damaged or missing	Contact PFS, Inc. for new muffler insert, P/N 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.
Excessive vibration	Tailpipe contacting cowling	Check for wear marks on 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.
	Ball Joint too Loose (On Systems with Flanged Ball Joints)	Tighten Ball Joint
	Broken Exhaust Hanger (On Systems with Rubber Strap Hangers)	Replace Exhaust Hanger
	Propeller not properly balanced	Have propeller dynamically balanced
	Support Rod Interference (On Systems equipped with Support Rods)	Inspect support rod routing and confirm that it does not contact the engine mount, cowling, or firewall. Be sure to provide sufficient clearance to allow some movement of the muffler.
	Worn Engine Mounts	Inspect engine mounts and replace as necessary.





## **6.4 Maximizing Service Life**

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

- 6.4.1 Dynamically balance your propeller to below 0.2 ips (inches per second) every 4 years or 1000 hours (whichever occurs first).
- 6.4.2 Dynamically balance your propeller to below 0.2 ips after modifying, overhauling, dressing, or replacing any rotating component on the engine or propeller.
- 6.4.3 Keep slip joints lubricated with a high temperature anti-seize (MIL-A-907E or equivalent). Do not use penetrating oil or solvent for long-term lubrication.
- 6.4.4 Maintain even engine compressions above 70/80 psi.
- 6.4.5 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.

## **6.5 Removal**

- 6.5.1 Remove the lower cowling in accordance with the Piper Service Manual. If the classic style tailpipe is installed, it must be removed before the cowling.
- 6.5.2 If the short stack style tailpipe is installed, disconnect the tailpipe hanger by removing the cushion clamps from around the engine mount tubes.
- 6.5.3 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.**
- 6.5.4 Remove EGT probes (if installed).
- 6.5.5 Remove nuts and washers attaching header pipes to the exhaust studs.
- 6.5.6 Drop the exhaust assembly as one complete unit.

## **6.6 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 latest revision of the Aircraft Service Manual and this document at either 100 hour or Annual intervals. It is recommended that the technician maintaining the exhaust system become familiar with the latest revision of FAA AC 91-59.

All components displaying cracking or general deterioration must be replaced with new parts, rebuilt, or repaired in accordance with the latest approved revision of AC 43.13.

- 6.6.1 Loosen and remove shrouds so that all surfaces of the exhaust system are visible.
- 6.6.2 Check for holes, cracks, and burned spots. Especially check areas adjacent to welds. Look for exhaust gas deposits in surrounding areas. This may indicate an exhaust leak.



*Installation Instructions and  
Instructions for Continued Airworthiness  
Kit: PFS-14150/14151*

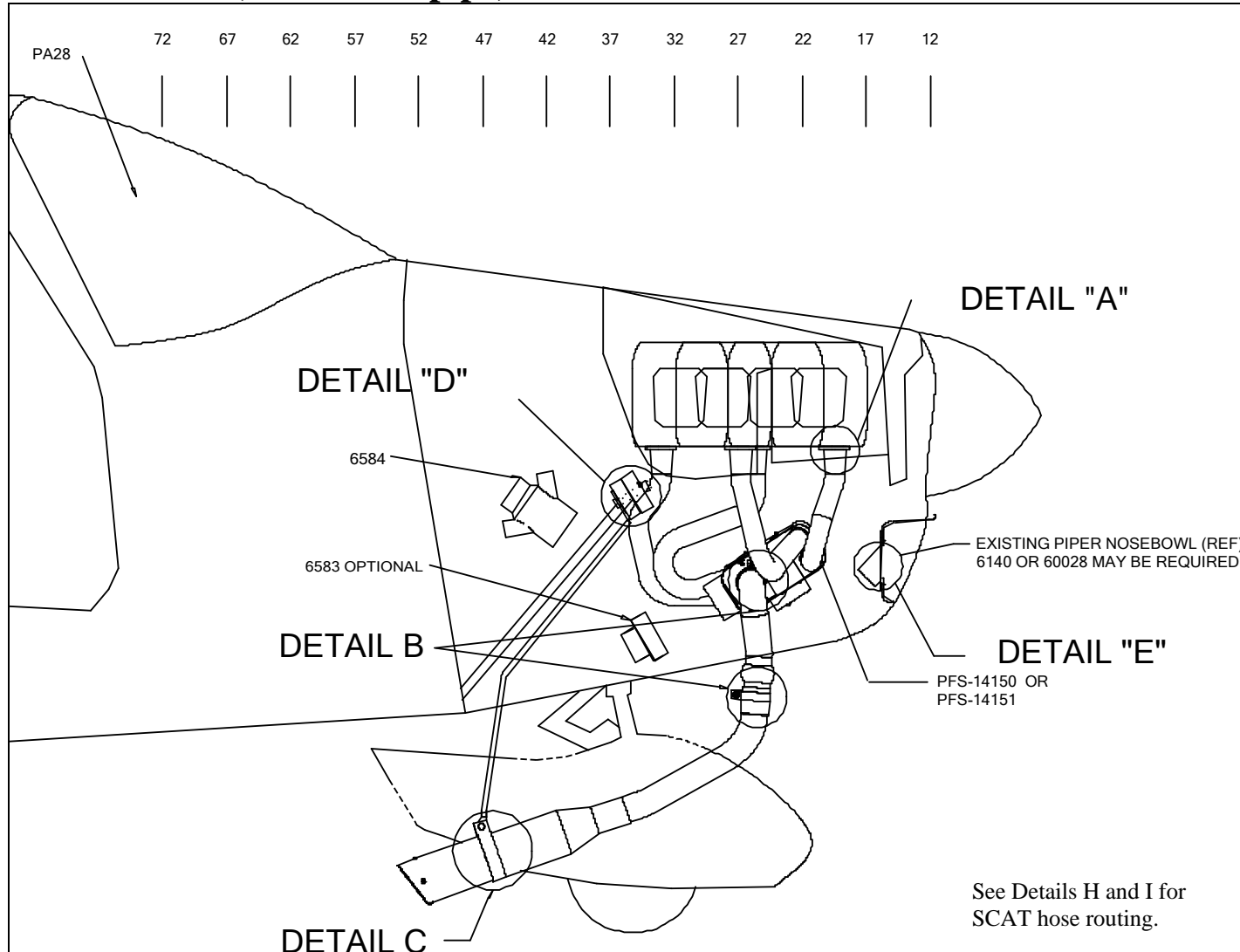
- 6.6.3 Inspect the ball joint for freedom of movement. A seized ball joint may cause other components to crack. If penetrating lube won't free a seized ball joint, please contact Power Flow Systems, Inc. for a replacement.
- 6.6.4 Inspect the nosebowl flange extension (PN 6140) if installed for any cracking. Also, ensure that no unfiltered air could get through the flange into the carburetor. If your flange was stitch welded, the areas between the welds can be filled with an aircraft grade RTV silicone or equivalent product.
- 6.6.5 Inspect the muffler insert for wear or deterioration. If the fiber packing is missing or the perforated tube is damaged, replace the insert. Replacement inserts (P/N PFS-8016) are available from Power Flow Systems, Inc.
- 6.6.6 Inspect screen covering carb heat outlet. Screens must be secure with no risk of material breaking off.
- 6.6.7 Inspect pins on clamps. Pins should not indicate excessive wear or cutting.
- 6.6.8 Inspect holes that pins are inserted in for elongation.
- 6.6.9 Ensure 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.
- 6.6.10 All slip joints must be disassembled and lubricated with a high-temperature anti-seize compound (MIL-A-907E or equivalent, do not use penetrating oil or solvent) at Annual intervals (within the preceding 12 calendar months). While disassembled, inspect for wear or galling. This shall be performed more frequently if headers seize between inspections.

**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:

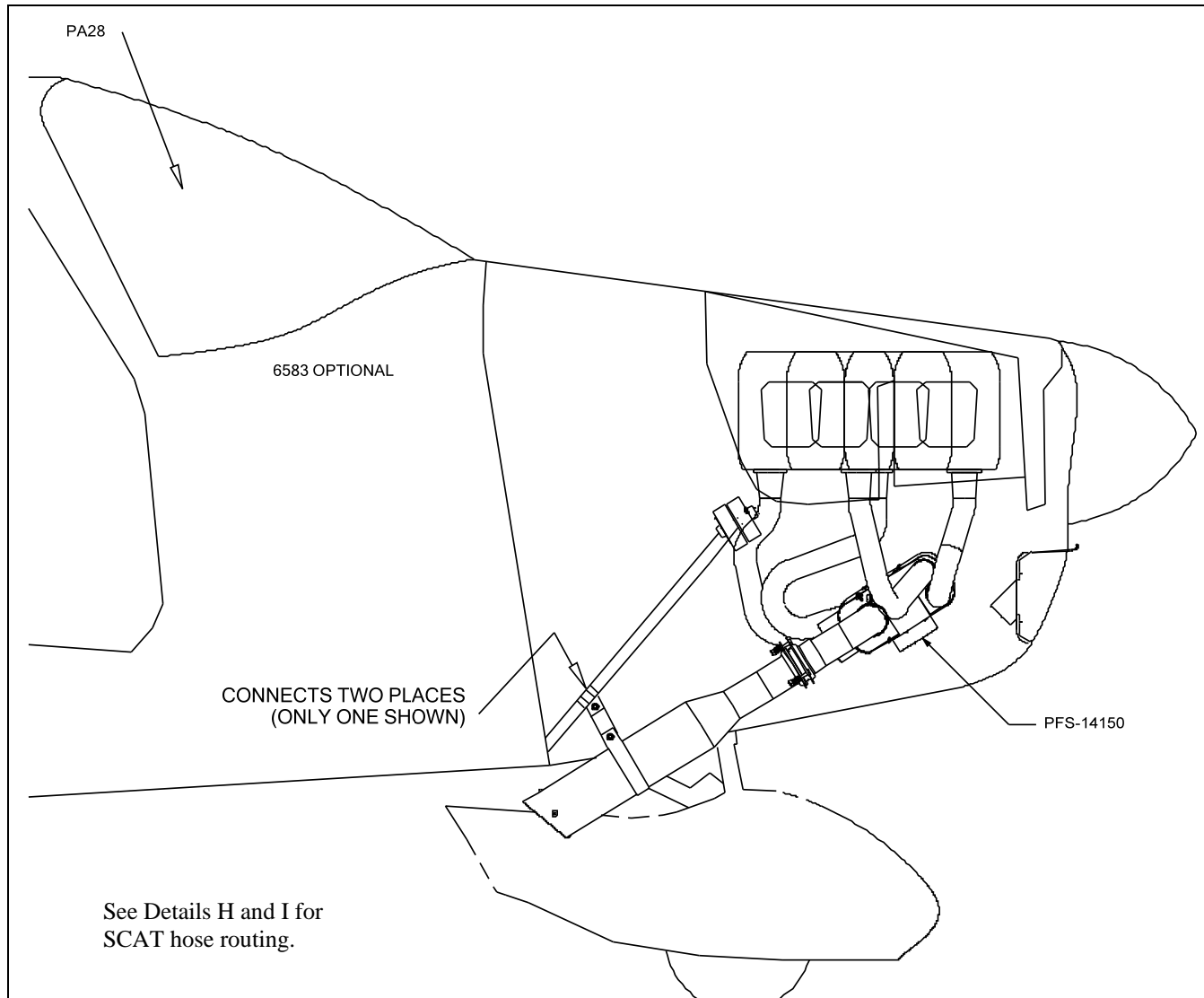
- Remove exhaust pipes and collector assembly.
- Remove shrouds.
- Seal openings with expansion rubber plugs.
- Submerge the collector assembly in water.
- Using a manometer or pressure gauge, apply 3.0 to 3.5 PSI (approximately 7" Hg) of air pressure.
- Let the unit sit pressurized for 10 to 30 seconds.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



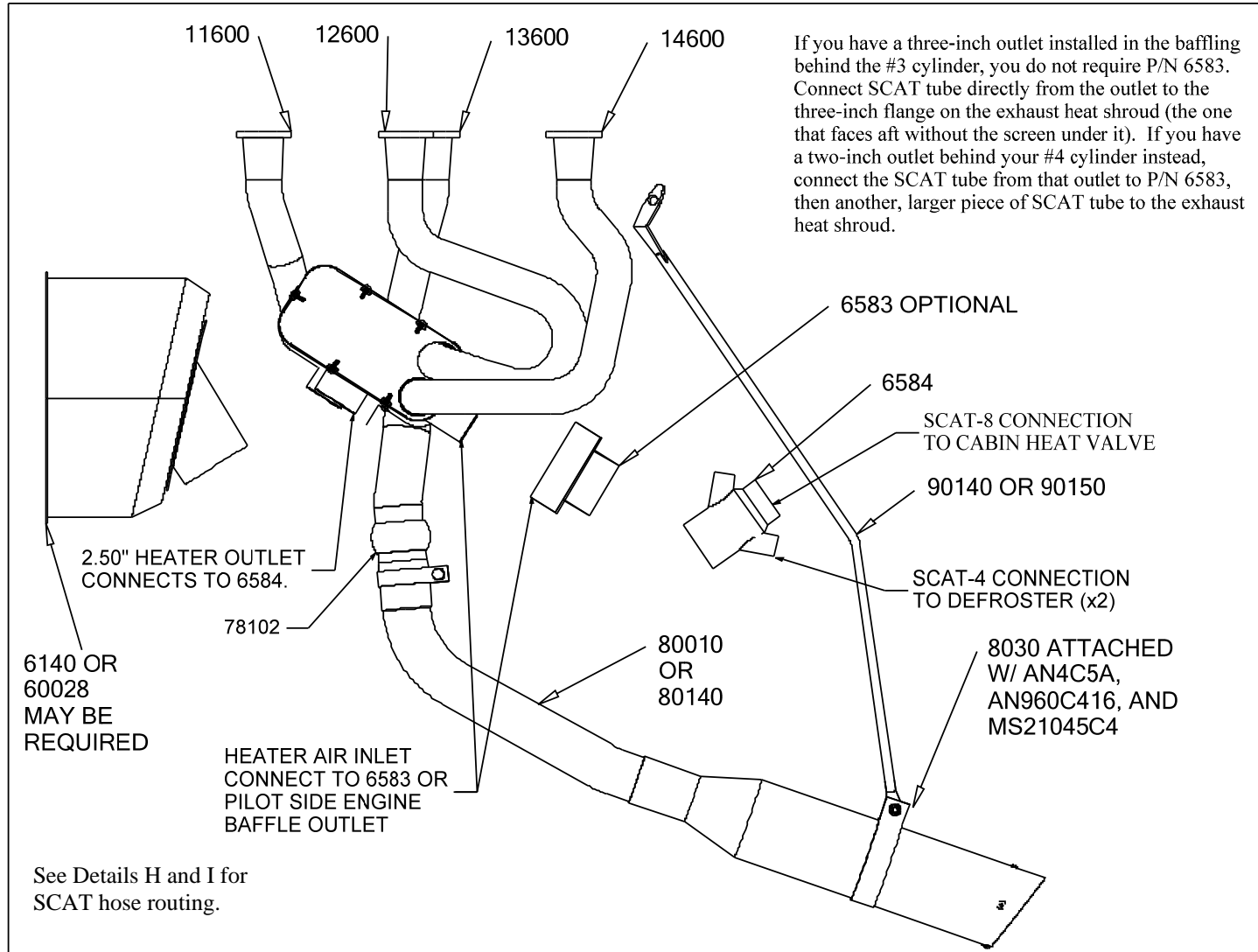
## Installation Overview (Classic Tailpipe)



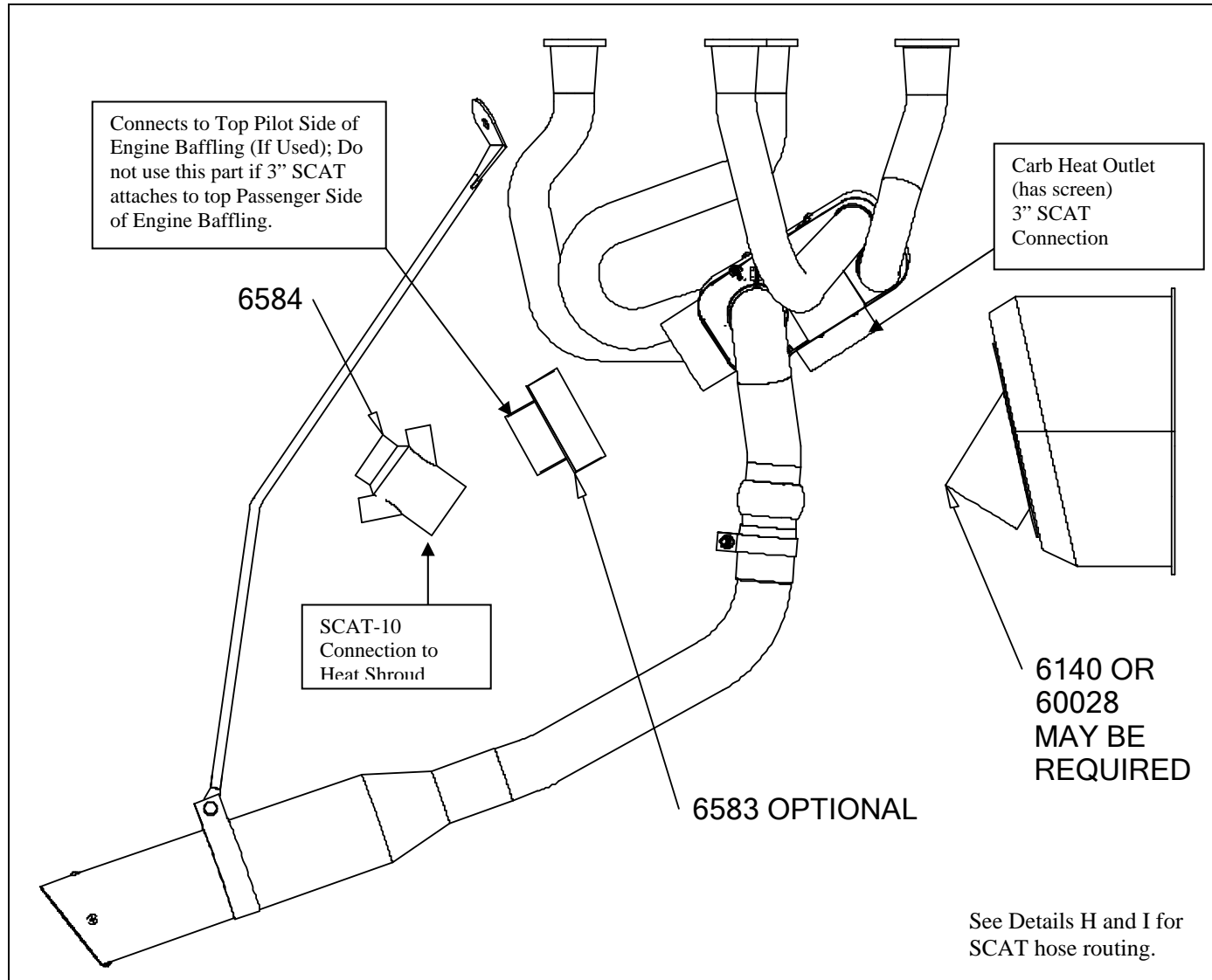
## Installation Overview (Short Stack Tailpipe)



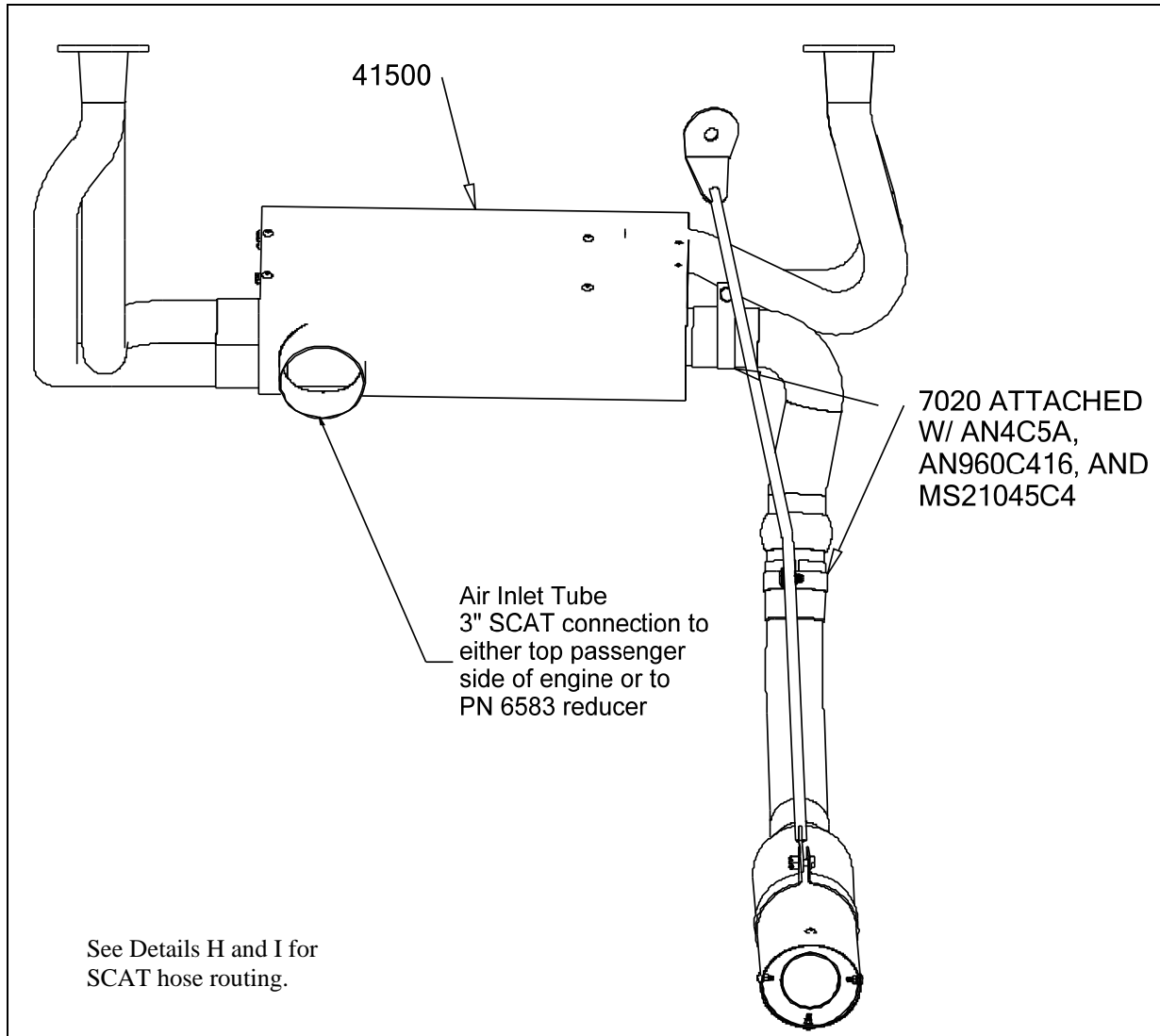
### Pilot Side View (Classic Tailpipe)



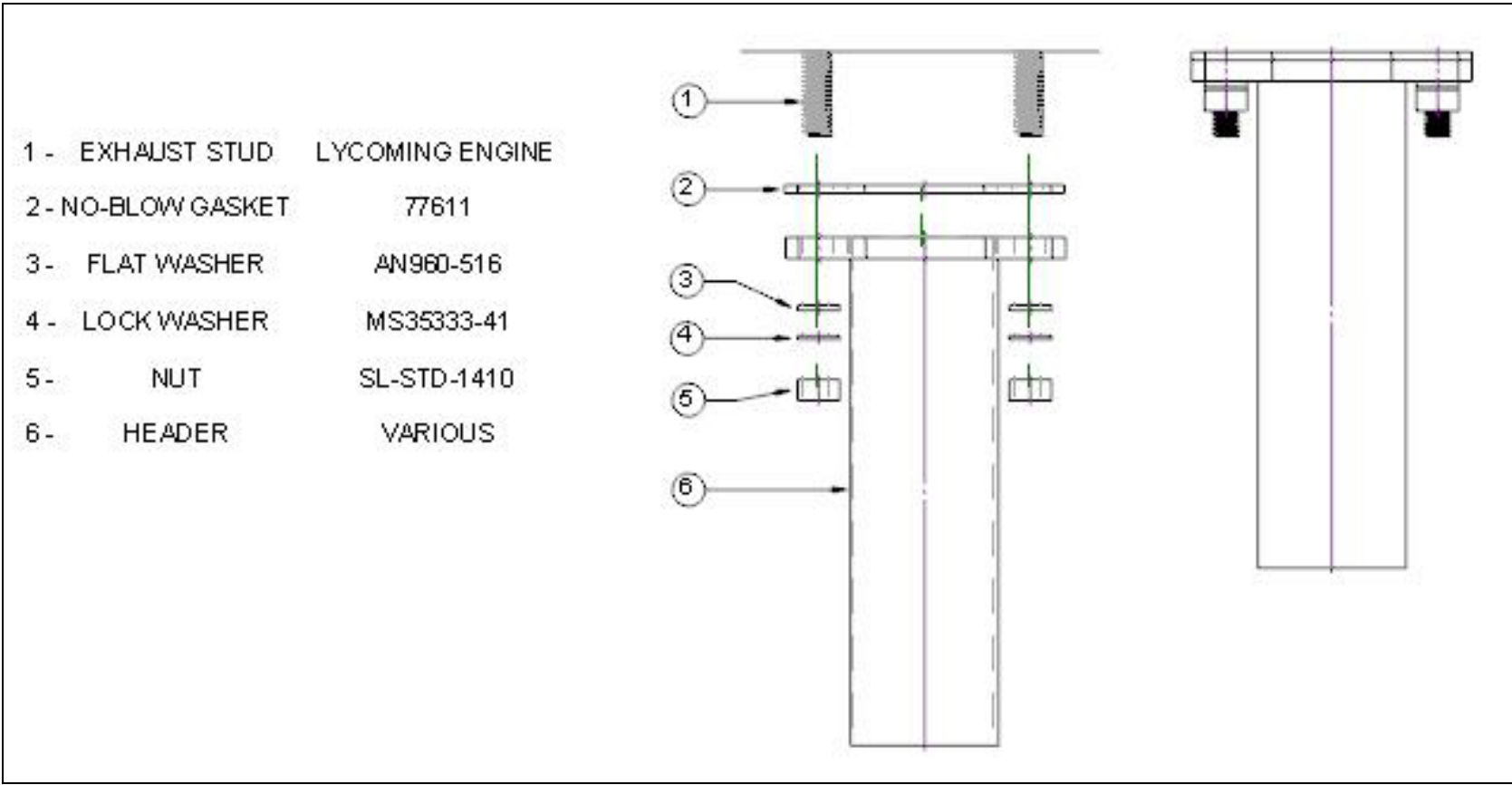
### Passenger Side View (Classic Tailpipe)



**Rear View (Classic Tailpipe)**

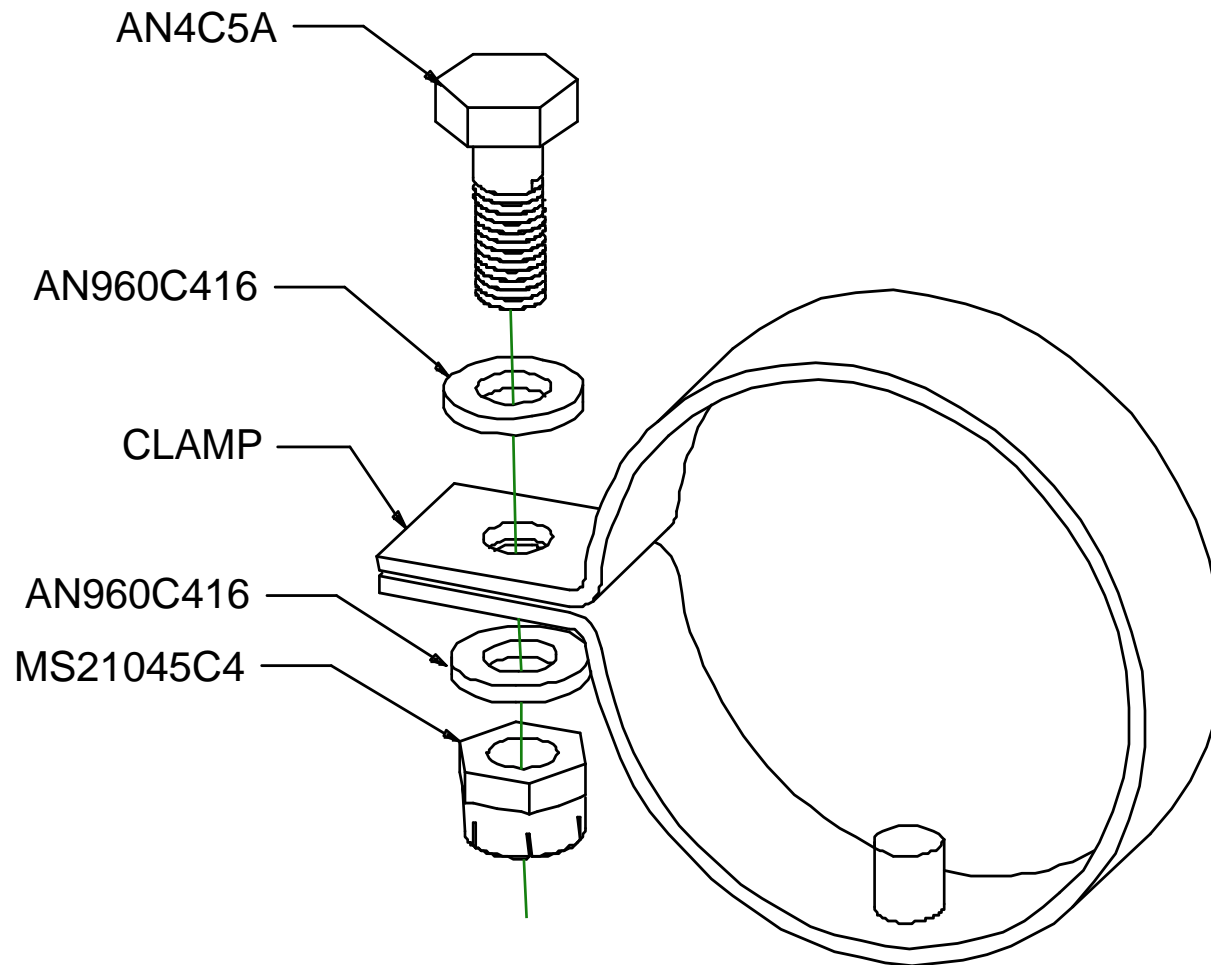


### Detail A



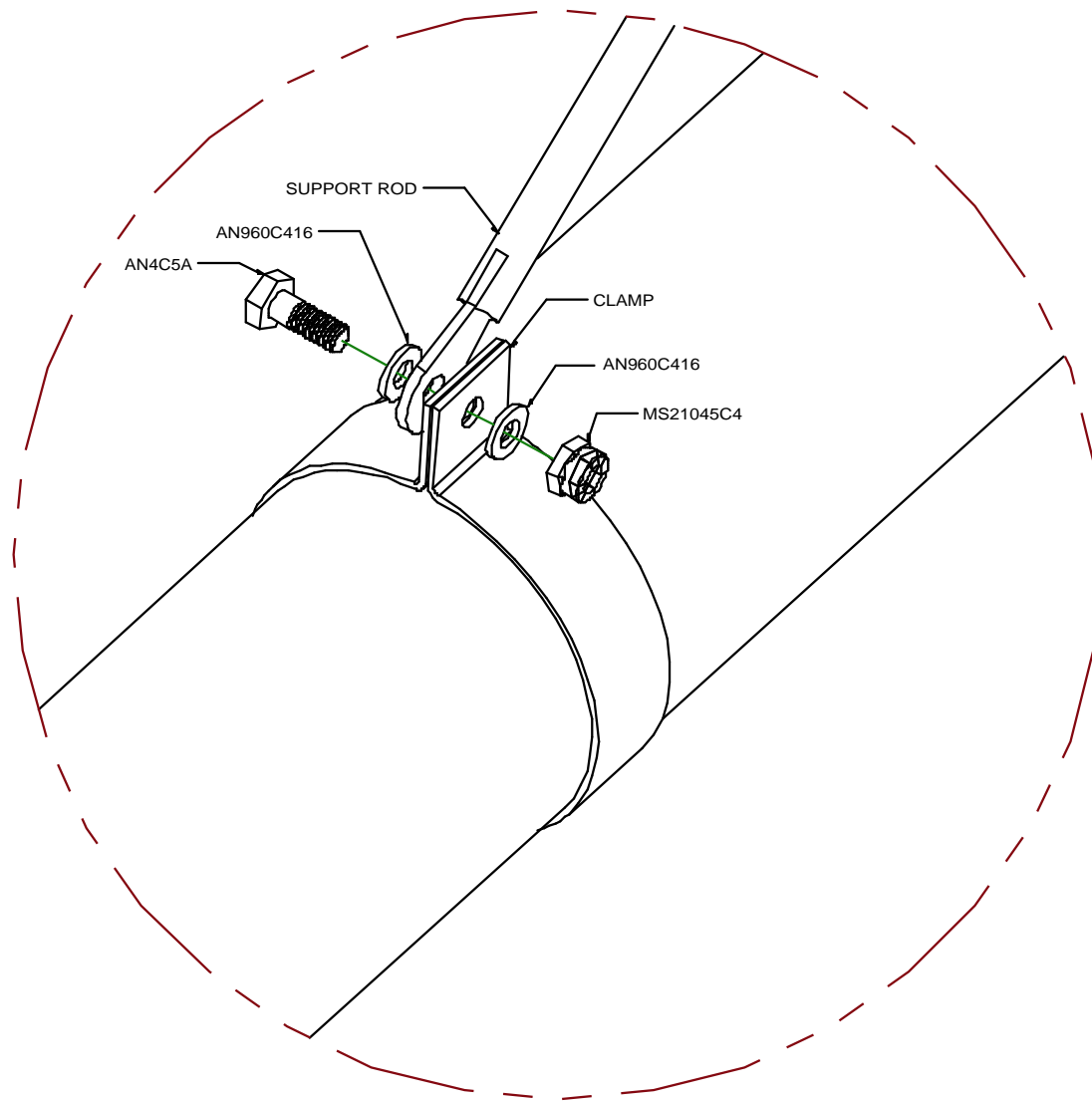
Equivalent Hardware may be used.

**Detail B**



*Power Flow System Extractor Exhaust System Installation Instructions*  
*Piper PA28 Aircraft*

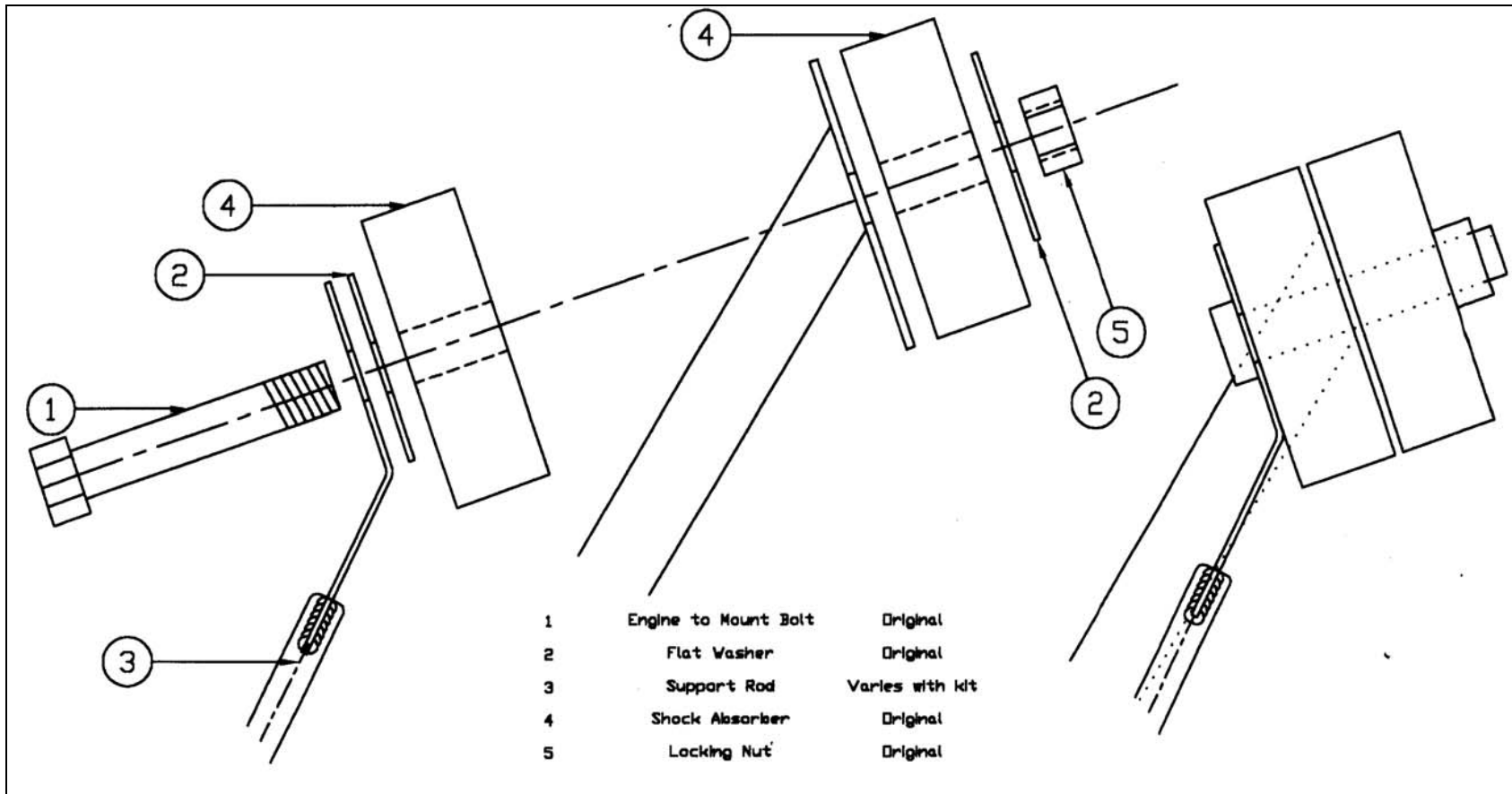
**Detail C**





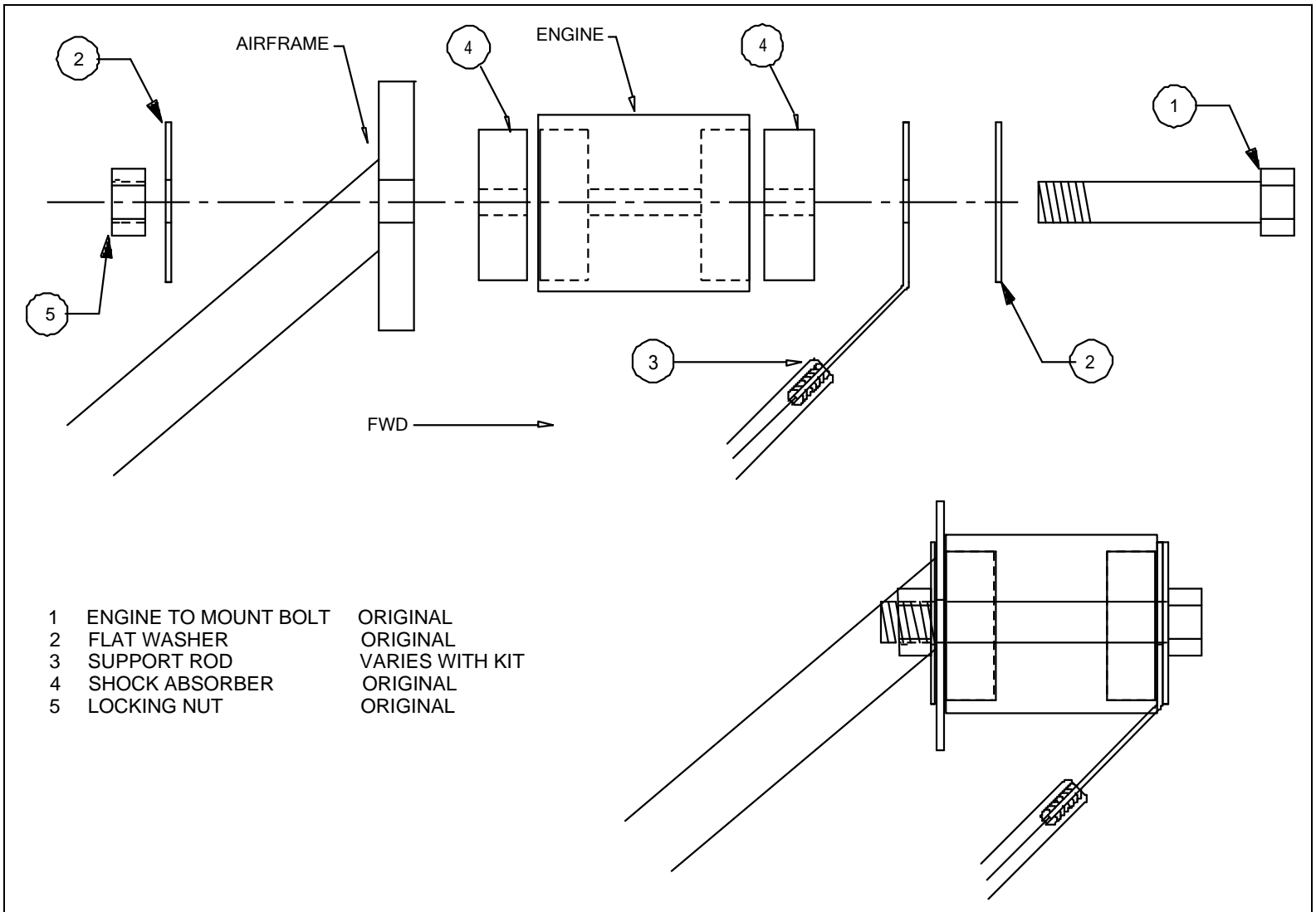
*Power Flow System Extractor Exhaust System Installation Instructions*  
*Piper PA28 Aircraft*

**Detail D – Dynafocal Mounts**



*Power Flow System Extractor Exhaust System Installation Instructions  
Piper PA28 Aircraft*

**Detail D – Conical Mounts**

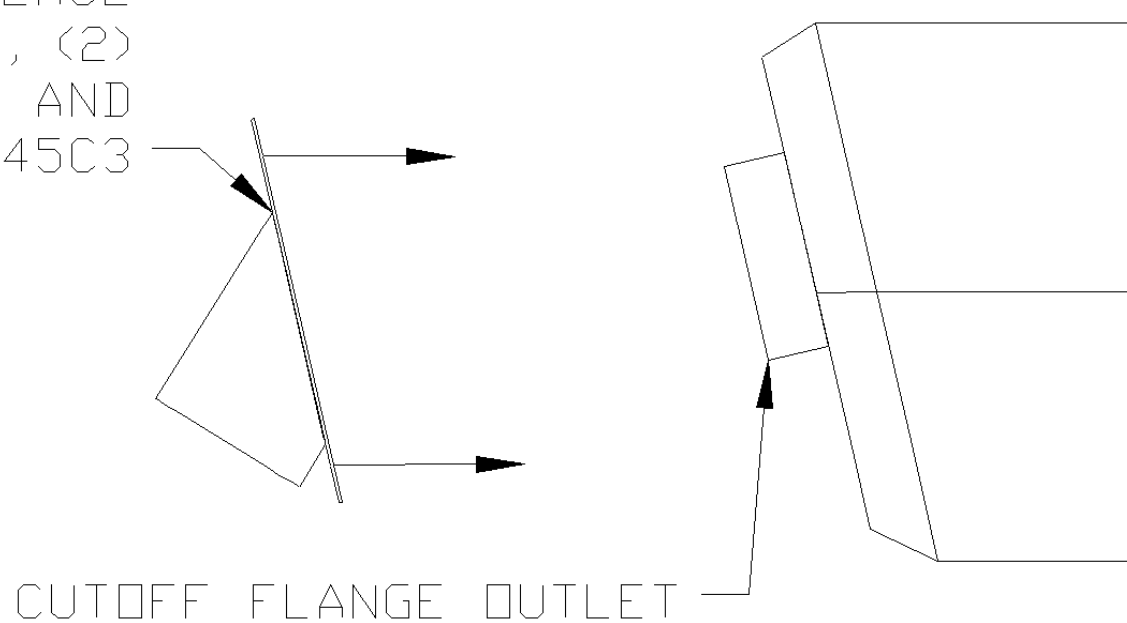


*Power Flow System Extractor Exhaust System Installation Instructions*  
*Piper PA28 Aircraft*

**Detail E**

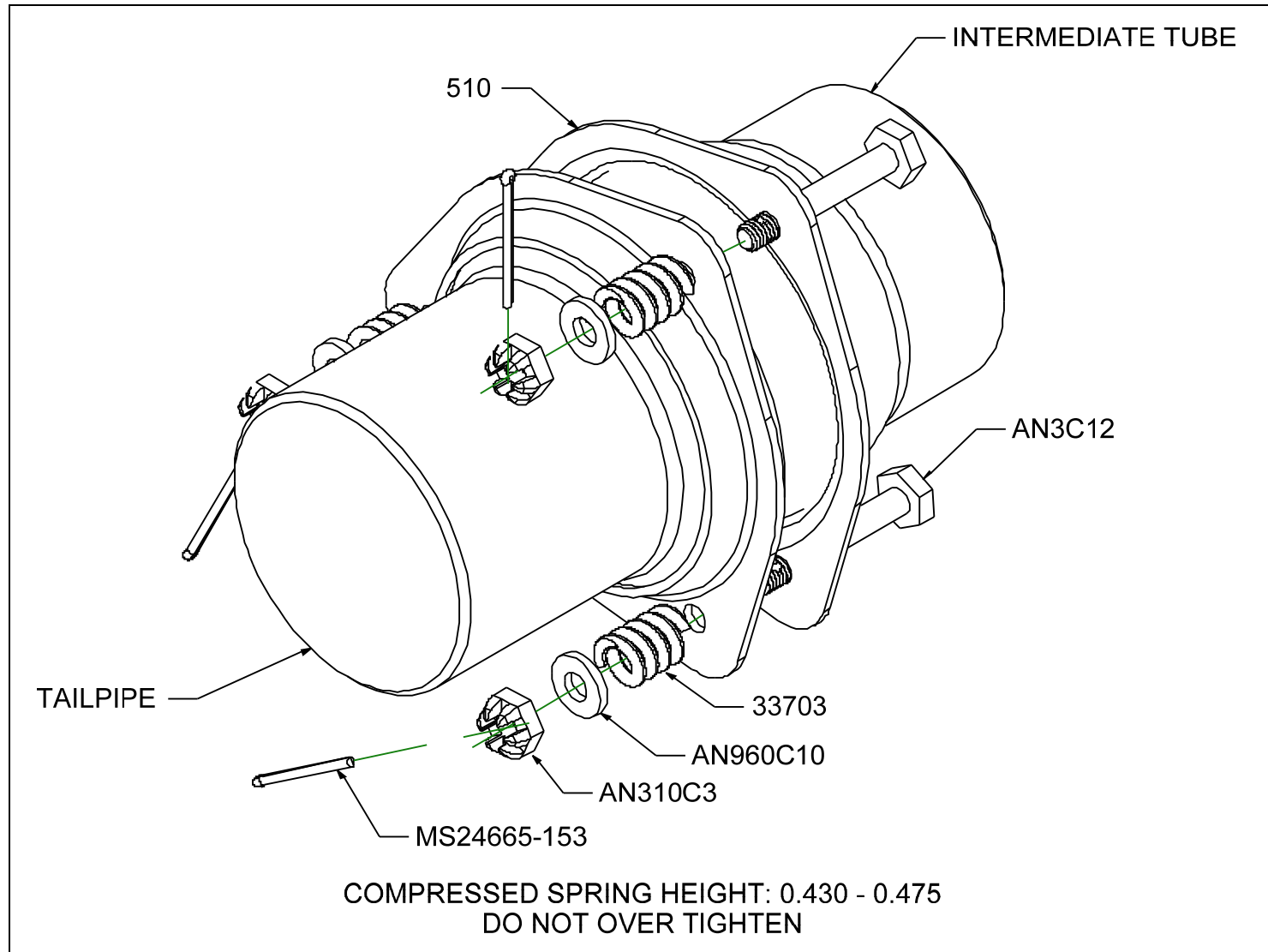
# NOSEBOWL MODIFICATION

ALIGN OVER HOLE  
AND BOLT IN PLACE  
W/ MS51958-64, (2)  
AN960C10, AND  
MS21045C3



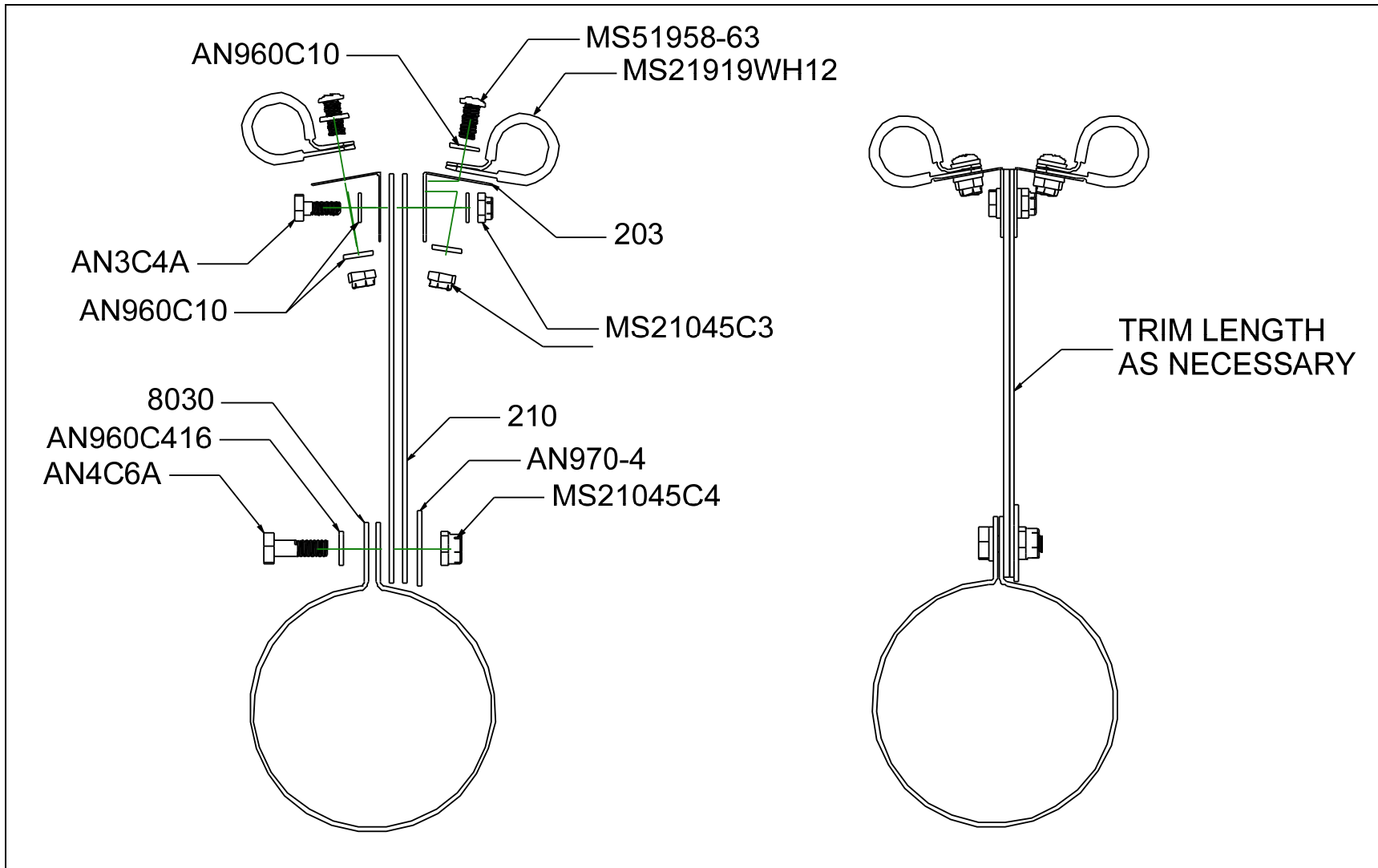
*Power Flow System Extractor Exhaust System Installation Instructions*  
*Piper PA28 Aircraft*

**Detail F**



*Power Flow System Extractor Exhaust System Installation Instructions*  
*Piper PA28 Aircraft*

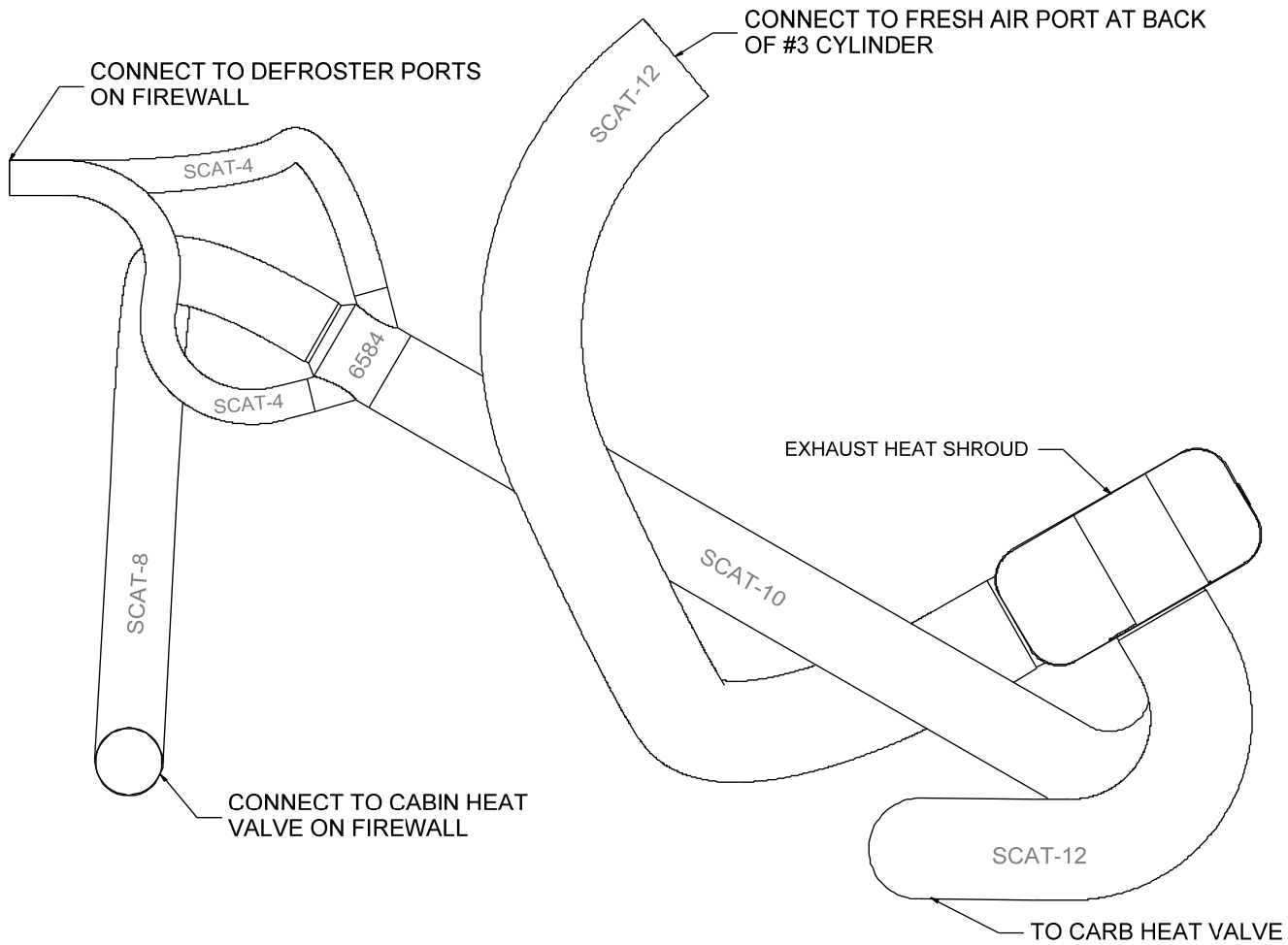
**Detail G**



*Power Flow System Extractor Exhaust System Installation Instructions*  
*Piper PA28 Aircraft*

**Detail H**

**SCAT ROUTING  
3" STARBOARD FRESH AIR INLET**

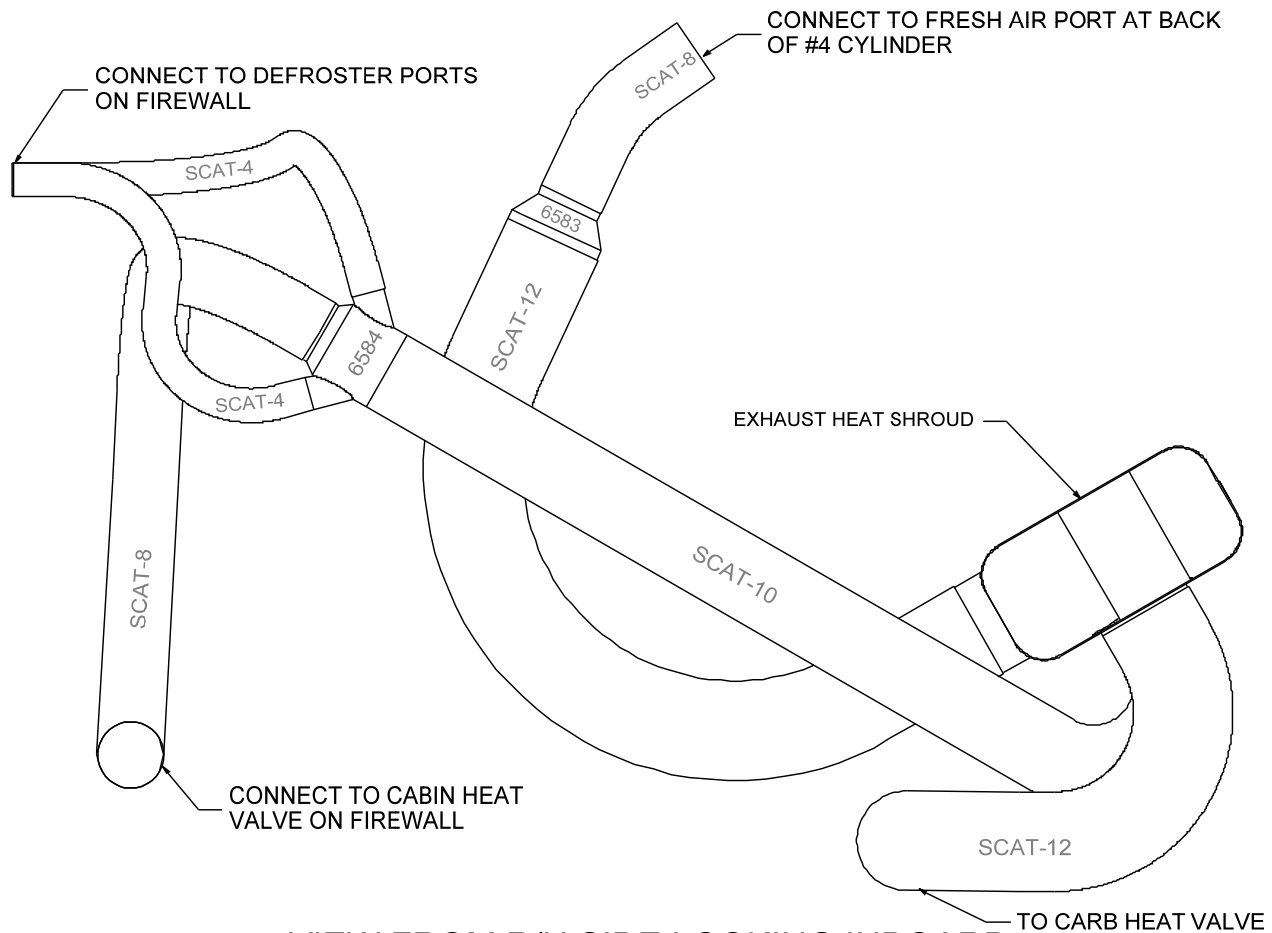


**VIEW FROM R/H SIDE LOOKING INBOARD**

*Power Flow System Extractor Exhaust System Installation Instructions*  
*Piper PA28 Aircraft*

**Detail I**

**SCAT ROUTING  
2" PORT-SIDE FRESH AIR INLET**



**VIEW FROM R/H SIDE LOOKING INBOARD**

United States of America  
Department of Transportation -- Federal Aviation Administration  
**Supplemental Type Certificate**

*Number* SA02168AT

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  
Hanger #804  
Daytona Beach, FL 32114

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

*Original Product - Type Certificate Number:* 2A13

*Make:* Piper

*Model:* PA-28 -140, -150, -160, -180,  
-181

*Description of Type Design Change:*

Modification of engine exhaust system for improved engine performance by installation of a Power Flow System Extractor Exhaust System per Power Flow Systems, Inc. (Formerly Laminar Flow Systems, Inc.):  
For PA-28-140, -150 and 160 models: Per Piper PA-28-140 Installation Instructions Report No. PFS-0008-00, Rev. IR, dated: April 12, 2000 ; Laminar Flow Systems, Inc. Master Drawing List, Report No. PFS-0005-00, Rev. C, dated: July 24, 2000 and Instructions for Continued Airworthiness, Report No. PFS-0006-00, Rev. IR, dated: April 10, 2000 or later FAA approved revision.  
For Piper Models, PA-28-180/181: Per Power Flow Systems, Inc. Installation Instructions, Report No. PFS-14150-00, Rev. IR dated 8/26/2002 and Master Drawing List, Report No. PFS-14140-00, Rev. IR dated 8/26/2002 or later FAA approved revision.  
For all models, except -181, equipped with single tailpipe stock exhaust systems: Per Power Flow Systems, inc. Installation instructions and Instructions for Continued Airworthiness, Document PFS-142500-00, Rev. A, dated January 28, 2003 and Master Drawing list PFS-14240-00, Rev. IR, dated January 22, 2003, or later FAA approved revision.

*Limitations and Conditions:*

Airplane Flight Manual Supplement is not required for 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 determine 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:* May 20, 1999

*Date reissued:*

*Date of issuance:* August 08, 2000

*Date amended:* September 16, 2002; February 28, 2003



*By direction of the Administrator*

*Melvin D. Taylor*  
(Signature)

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.