REPORT NAME: PFS-13204, PFS-13205 Tuned Exhaust System Installation Instructions and Instructions for Continued Airworthiness

REPORT NUMBER: PFS-13250-00

REVISION: G

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AIRCRAFT APPLICABILITY: Cessna 172 and Cessna 175 with Lycoming Engines

PREPARED BY: T. STROHMAYER

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STC Number: SA01801AT

REVISION CONTROL

| REVISION | DATE | REMOVE PAGES | INSERT PAGES |
|---|---|---|---|
| IR | 10/03/02 | N/A | N/A |
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| B | 12/09/02 | 1,8,9 | 1,8,9 |
| C | 10/20/03 | 1-7,9,10-17,22 | 1-7,9,10-17,22 |
| D | 07/02/04 | 1,4,7,8,9 | 1,4,7,8,9 |
| E | 08/11/04 | ALL | ALL |
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| G | 07/23/09 | ALL | ALL |

FAA APPROVED
Date 9-23-09 Initials
ACE-118A

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# 1.0 INTRODUCTION

## 1.1 General

- 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.
- Customers with classic tailpipes please note: 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.

## 1.2 Upgrading

- The installer should complete FAA 337 paperwork (or their international equivalent) for upgrade installations. All upgrades are approved under the original STC number. The STC has been provided as the last page of these instructions.
- The new parts will be warranteed for 1 year or 500 tach hours, following their installation, whichever comes first. Parts that are reused will be subject to their original warranty and will be covered based on the time of their initial installation.
- If you require a new muffler (Ceramic Coated Mufflers are now available) or muffler insert (P/N 8016), please contact Power Flow Systems, Inc. for details.

### 1.2.1 Upgrading from "Classic System"

- If you are upgrading from a PFS-13201, PFS-13202, or PFS-13203 exhaust system you will need to reuse your existing support rod, muffler, and muffler clamp (unless upgraded to Short Stack tailpipe at the same time). New hardware has been provided.

### 1.2.2 Upgrading to "Short Stack" Tailpipe

- If your exhaust system has already been installed, and you are just upgrading to the Short Stack tailpipe, skip to Section 4.3 of the installation instructions. Before you begin, remove the support rod (PN 90020) from the lower right engine lord mount (be sure to reinstall the bolt and torque to the aircraft or engine manufacturer's recommended value). Also, remove the intermediate tube (PN 78102) from the 4-1 outlet. If a hole was cut in your cowling for the support rod to pass through, you

may wish to patch the hole. This should be done in accordance with the latest revision of AC43.13.

### 1.2.3 Upgrading from a Lycoming O-320 to O-360

- If upgrading your aircraft from an O-320 engine to an O-360 engine, you will need to change your number 2 and number 4 headers.
- If your O-360 airbox requires a 3.0" carb heat adapter, contact Power Flow Systems, Inc. for a P/N 6583 adapter.
- If your new engine uses a 2.5" carb heat connection and your previous engine used a 2.0" carb heat connection, cut off the reducer portion of the carb heat outlet on the heat shroud.

# 2.0 KIT CONTENTS

## 2.1 Classic Tailpipes

| ***Quantity*** | ***Part Description*** | ***Part Number*** |
|---|---|---|
| 1 | #1 Header | 11600 |
| 1 | #2 Header | 12600* |
| 1 | #3 Header | 13600 |
| 1 | #4 Header | 14600* |
| 4 | No-blow Header Gasket | 77611 |
| 8 | Exhaust Nut | SL-STD-1410 |
| 8 | Lock Washer | MS35333-41 |
| 8 | Plain Washer | AN960-516 |
| 1 | Shrouded Collector Assembly | 41722** |
| 1 | Exhaust Extension Assembly | 78102 |
| 2 | Exhaust Clamp (2” with pin) | 7020 |
| 3 | Bolt | AN4C5A |
| 3 | Castle Nut | AN310C4 |
| 3 | Cotter Pin | MS24665-153 |
| 8 | Flat Washer | AN960C416 |
| 1 | Adel Clamp size 6 | MS21919WH6 |
| 1 | Adel Clamp size 12 | MS21919WH12 |
| 1 | Locknut | MS21044C3 |
| 1 | Bolt | MS51958-63 |
| 2 | Flat Washer | AN960C10 |
| 1 | Muffler Assembly | 80010 |
| 1 | Support Rod | 90020 |
| 1 | Muffler Clamp (3 1/2” without pin) | 8030 |
| 42” | Scat Tubing | SCAT-12 |

Equivalent hardware may be supplied.
*Aircraft with O320 Engines will receive 12600-1 and 14600-1 headers.
**Cessna 172R and 172S will use P/N 41723.

## 2.2 Short Stack Tailpipes

| ***Quantity*** | ***Part Description*** | ***Part Number*** |
|---|---|---|
| 1 | #1 Header | 11600 |
| 1 | #2 Header | 12600* |
| 1 | #3 Header | 13600 |
| 1 | #4 Header | 14600* |
| 4 | No-blow Header Gasket | 77611 |
| 8 | Exhaust Nut | SL-STD-1410 |
| 8 | Lock Washer | MS35333-41 |
| 8 | Plain Washer | AN960-516 |
| 1 | Shrouded Collector Assembly | 41722** |
| 1 | Short Stack Tailpipe Assembly | 80011 |
| 1 | Exhaust Clamp (2” with pin) | 7020 |
| 1 | Drilled Bolt | AN4C5 |
| 1 | Castle Nut | AN310C4 |
| 1 | Cotter Pin | MS24665-153 |
| 2 | Flat Washer | AN960C416 |
| 42” | Scat Tubing | SCAT-12 |

Equivalent hardware may be supplied.
*Aircraft with O320 Engines will receive 12600-1 and 14600-1 headers.
**Cessna 172R and 172S will use P/N 41723.

# 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 lower cowl components in accordance with the latest approved revision of the Aircraft Service Manual.

3.2 Disconnect flexible ducts from muffler assembly.

3.3 Cover heat carb inlet to prevent debris from entering the carburetor (if applicable).

3.4 Remove EGT probe(s), if installed.

3.5 Remove nuts attaching exhaust pipes to exhaust studs.

3.6 Remove exhaust pipes and exhaust gaskets.

3.7 The PFS Carburetor heat outlet is designed to accept 2 common sizes of SCAT hose. If your hose is 2.5" in diameter, cut off and de-burr the reducer portion of the adapter. If your aircraft uses a 3" carb heat connection, install PN 6583 (reducer) to step your 3" SCAT hose down to 2" for attachment to the carb heat shroud. Be sure that the SCAT tube routing does not interfere with any moving parts. PN 6583 can be installed with two band clamps. (Not applicable to fuel injected engines).

# 4.0 INSTALLATION OF THE PFS EXHAUST SYSTEM

## 4.1 Installing Collector Box assembly and Exhaust pipes:

Both collector styles, 41722 and 41723, are installed in the same manner.

4.1.1 Insert the number 1 and number 3 exhaust header pipes into the collector assembly as per the numbering on the collector and headers. Be sure to use the alignment marks. A minimum of 1 ½ " penetration is required for proper operation. 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; be sure the shroud inlet tube passes cleanly through the front baffle. Start a nut on each header to hold the entire assembly in place. See Detail "A", Passenger and Pilot Side Views.

4.1.2 Insert the number 2 and number 4 header pipes into the collector assembly as per the numbering on the collector and headers. Be sure to use the alignment marks. A minimum of 1 1/2" penetration is required for proper operation. Be sure to use the new gaskets provided. If the system is being re-installed and alignment marks are not visible, set the collector box to a 30 degree up-angle with respect to the engine centerline and make sure all headers are inserted equally (about 1.6 inches).

4.1.3 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.

4.1.4 Install EGT Probes (If Applicable) I.A.W. the manufacturer's recommendations. All probes should be the same distance from the port, typically 2-4 inches.

4.1.5 Install flexible tubing to shroud connections. The cabin heat outlet is on the aft-pilot side of the shroud (PN 41722 and PN 41723). PN 41722 has a carb heat outlet on the passenger side of the shroud. PN 41723 does not have a carb heat outlet.

## 4.2 Classic Tailpipe Installation

**If your exhaust has a Short Stack Tailpipe, Please Skip to Section 4.3.**

**Installing Support Rod P/N 90020:**

4.2.1 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. See Detail "D".

4.2.2 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. This large area washer may be omitted if the bolt is too short. See Detail "D". Ensure that the rod clears all engine compartment parts, and will exit the cowl well forward of the firewall, slightly outboard of the engine lord mount and directly above the muffler assembly (The muffler, PN 80010, can be temporarily installed onto exhaust extension PN 78102 to check this alignment). Also make sure that the end of the support rod will clear the bottom of the aircraft cowl.

4.2.3 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.

4.2.4 Using the Adel clamps provided, secure the support rod to the engine mount. MODIFYING THIS SUPPORT ROD OR FABRICATING ADDITIONAL SUPPORT MAY CAUSE PARTS TO FAIL AND WILL VOID YOUR WARRANTY.

4.2.5 Place the included template of the lower cowling according to the instructions on the template. Generally, cowlings built prior to 1972 do not require any hole cutting.

4.2.6 Cut out the hole as indicated. If the template doesn't fit, **or if you have any questions regarding this cut**, please call for assistance before cutting hole.

4.2.7 Slide the exhaust extension PN: 78102 all the way onto the end of the 4-to-1 collector. DO NOT drill for clamp installation, yet.

4.2.8 Position the lower cowl onto the airplane. Attach the cowl with enough screws to ensure the proper angle of the cowl. The support rod should pass cleanly through the hole drilled through the cowl, and the exhaust extension should pass through the middle of the stock exhaust outlet. It may be necessary to temporarily attach the upper cowl to attain the proper cowling angle.

4.2.9 Slide the muffler assembly, P/N 80010, over the exhaust extension outlet. It should be pushed up as far it can go, oriented straight back. The support rod should be contacting the muffler. You may have to make minor adjustments in alignment and rotation of both the muffler assembly and the exhaust extension assembly. 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.

4.2.10 Position the large clamp, P/N 8030, around the muffler so that it will attach to the support rod.

4.2.11 If a nose pant is installed, 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. 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.

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

**Installing Exhaust Extension and Muffler**

4.2.12 Install the large clamp (without the pin) so that the holes will align with the hole in the support rod. See Detail "C".

4.2.13 Drill a 0.25" hole through the pilot hole in the muffler through the exhaust extension.

4.2.14 Remove the muffler.

4.2.15 Remove the lower cowl.

4.2.16 Reattach the muffler and temporarily install the large clamp.

4.2.17 Drill a 0.25" hole through the flared end of the exhaust extension, about one inch from the end of the flare. Drill through the exhaust extension and the 4 to 1 collector. Be sure to de-burr all the holes or later removal of muffler components will be difficult.

4.2.18 Clamp the exhaust extension to the 4 to 1 using one of the provided 2" clamps (PN 7020). See Detail "B". The pin should insert with minimal force. If any binding exists, the hole may need further reaming.

4.2.19 Remove the muffler and re-install the lower cowl. Install the muffler assembly and clamp to the exhaust extension with the other 2" clamp. See Detail "B". Again, if the pin is a tight fit, further reaming of the hole may be necessary.

4.2.20 Clamp the muffler assembly to the support rod with the provided 3.5" clamp. See Detail "C".

4.2.21 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.

4.2.22 Depending on your aircraft, it may be necessary to slightly increase the size of the tailpipe opening in the cowling. Some aircraft with engine conversions may require more clearance on the outboard side of the tailpipe. If this is necessary, a doubler may be installed to cover some of the excessive opening on the inboard side of the tailpipe.

**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.**

## 4.3 Short Stack Tailpipe Installation

**If your exhaust has a Classic Tailpipe, Skip to Section 5.0**

4.3.1 Slide the tailpipe, PN 80011 all the way onto the end of the 4-to-1 collector. DO NOT drill for clamp installation, yet.

4.3.2 Position the lower cowl onto the airplane. Attach the cowl with enough screws to ensure the proper angle of the cowl (please note that the lower cowl may "sag" without the top cowl installed, for best results, we recommend installing the top cowl). The tailpipe should pass cleanly through the exhaust pipe opening. The pipe should be angled slightly outboard and slightly aft, just like the stock exhaust tailpipe.

4.3.3 Depending on your aircraft, it may be necessary to slightly increase the size of the tailpipe opening in the cowling. Some aircraft with engine conversions may require more clearance on the outboard side of the tailpipe. If this is necessary, a doubler may be installed to cover some of the excessive opening on the inboard side of the tailpipe.

4.3.4 Mark the junction of the slip joint to indicate the proper rotation angle.

4.3.5 Remove the cowling.

4.3.6 Drill a 0.25" hole through the flared end of the tailpipe, about one inch from the end of the flare.

4.3.7 Install clamp PN 7020 using provided hardware. See Detail B. The pin should insert with no more than moderate hand pressure. If binding exists the hole may need further reaming.

# 5.0 INSPECTION AND PAPERWORK

5.1 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.

5.2 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.

5.3 Install the placard (enclosed) in clear view of the pilot that reads:
"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."

5.4 Make appropriate entries in the logbook and on FAA Form 337. This modification is considered a major ***airframe*** change. The STC is located at the back of this instruction set for easy removal.

5.5 Typical Weight and Balance Information:

- The original Cessna Exhaust System weighs approximately 16.5 lbs at station –26.0.
- The Power Flow Systems, Inc. tuned exhaust system with the classic tailpipe weighs 22.75 lbs at station –21.0.
- The Power Flow Systems, Inc. tuned exhaust system with the short stack tailpipe weighs 19.0 lbs at station –24.1.

# 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 obtained by calling Power Flow Systems, Inc. at (386) 253-8833 or online at 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 rebuilt or replaced with new.

**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, rebuild, or replacement.**

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

6.2.4 Structural Inspection Procedure – See Section 6.6 Below.

## 6.3 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 Service Manual. |
| Excessive noise | Muffler insert damaged or missing | Contact PFS, Inc. for new muffler insert kit, PN 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. |

## 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 500 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.

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 Disconnect muffler support rod P/N 90020 from muffler clamp P/N 8030. (Classic tailpipes only)

6.5.2 Disconnect exhaust clamp P/N 7020 and remove muffler assembly P/N 80010 from exhaust extension P/N 78102. (Classic tailpipes only)

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

6.5.4 Disconnect flexible ducts from collector assembly.

6.5.5 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.

6.5.6 Remove EGT probes if installed.

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

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

6.5.9 Remove the 1 & 3 headers.

6.5.10 Remove the engine mount bolt and support rod if necessary (classic tailpipe only).

## 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 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 AC 43.13 or the latest approved revision.

6.6.1 Remove exhaust in accordance with paragraphs 6.5.1 through 6.5.9 above.
6.6.2 Loosen and remove heat shroud so that all surfaces of the exhaust system are visible.
6.6.3 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.
6.6.4 Inspect the baffling in the tailpipe. If the baffling is missing or deteriorated, it will require replacement. **Any** deformation of the round perforated tube within the classic tailpipe indicates that the insert must be replaced. New muffler and baffling inserts for both tailpipe styles are available from Power Flow Systems, Inc.
6.6.5 Inspect the ball joint for freedom of movement (classic tailpipes only). 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.
6.6.6 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. If worn or cut contact Power Flow Systems, Inc. for replacement.
6.6.8 Inspect holes that pins are inserted in for elongation. If elongated contact Power Flow Systems, Inc. for a replacement.
6.6.9 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 slip joints for wear or galling.
6.6.10 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.

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:

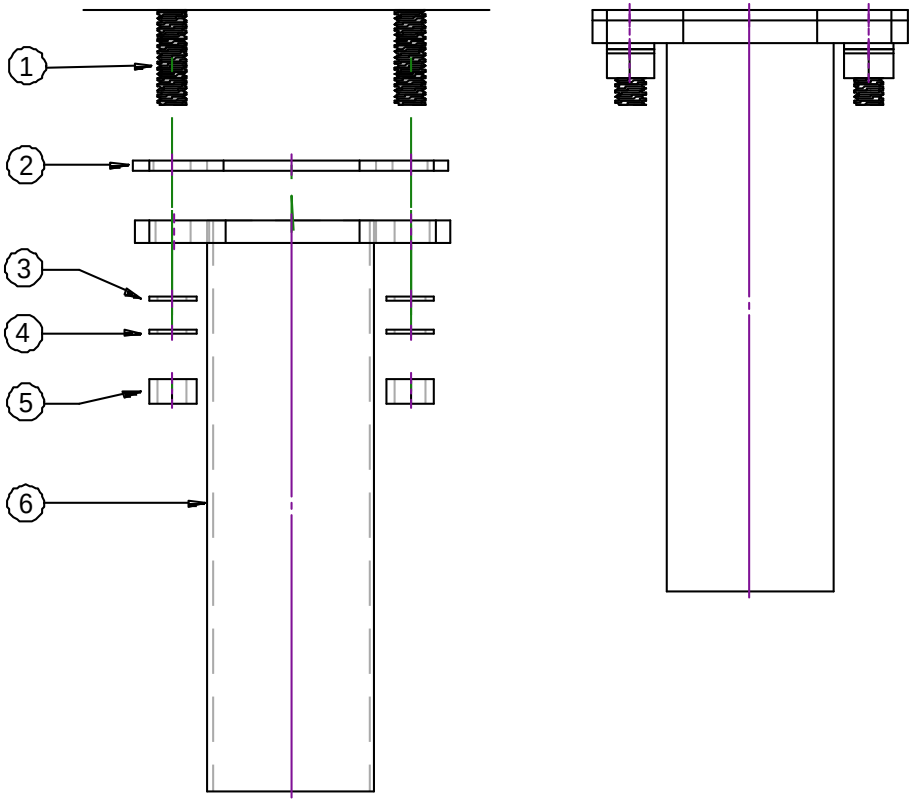
6.6.11 Remove exhaust pipes and heat exchanger assembly.
6.6.12 Remove shrouds.
6.6.13 Seal openings with expansion rubber plugs.
6.6.14 Submerge the collector assembly in water.
6.6.15 Using a manometer or pressure gauge, apply 3.0 to 3.5 PSI (approximately 7" Hg) of air pressure.
6.6.16 Let the unit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

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

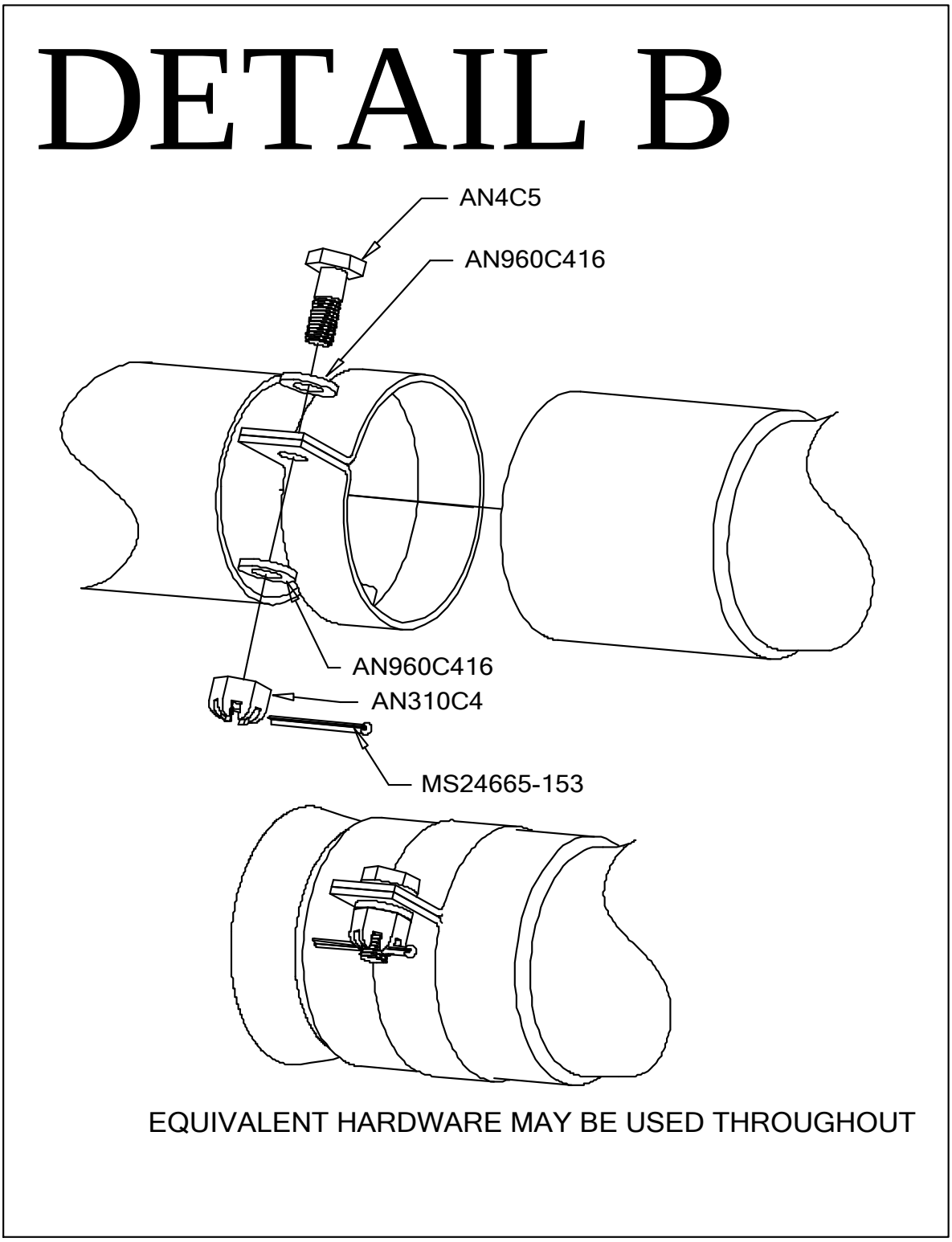
# DETAIL A

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

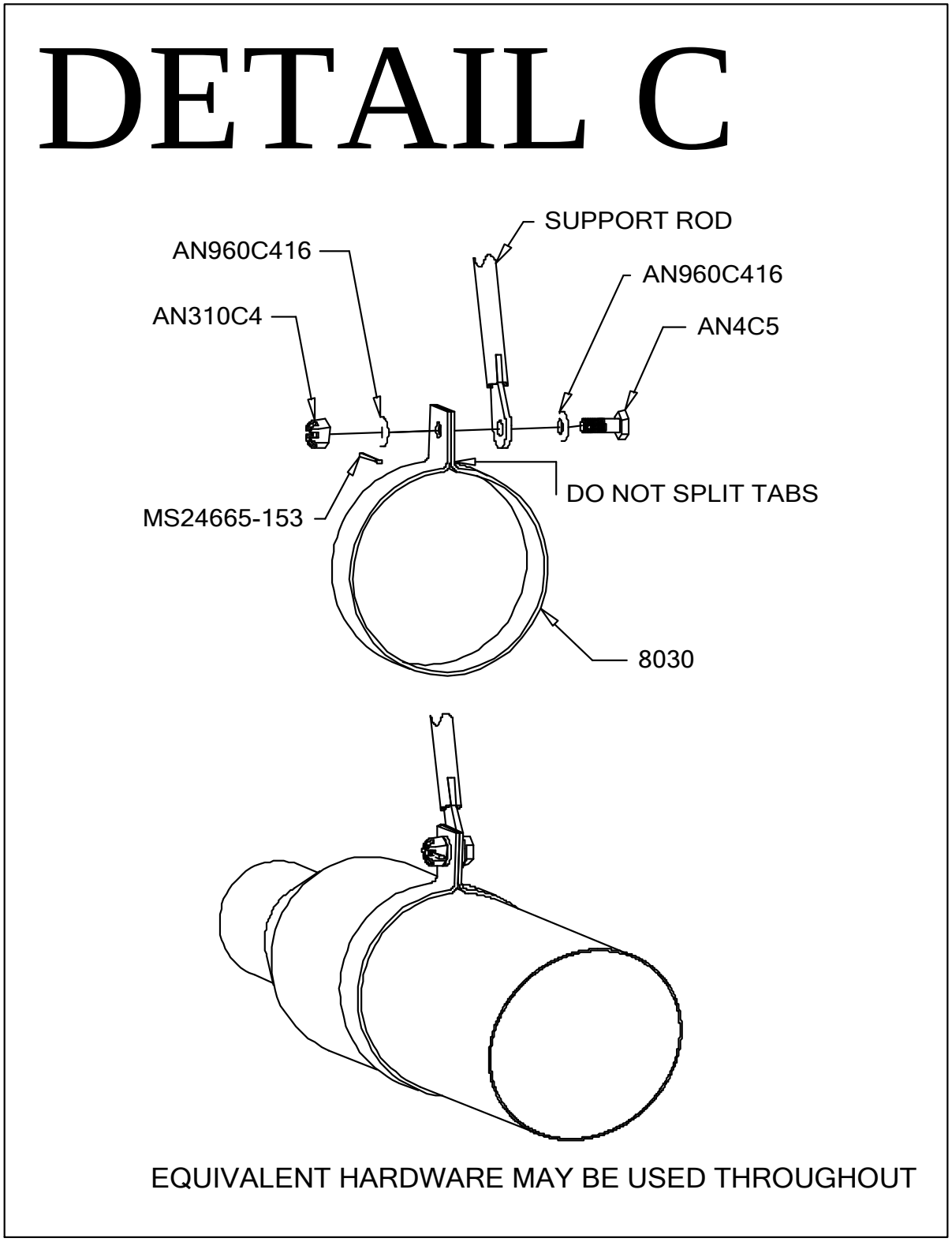
Equivalent Hardware May Be Supplied.



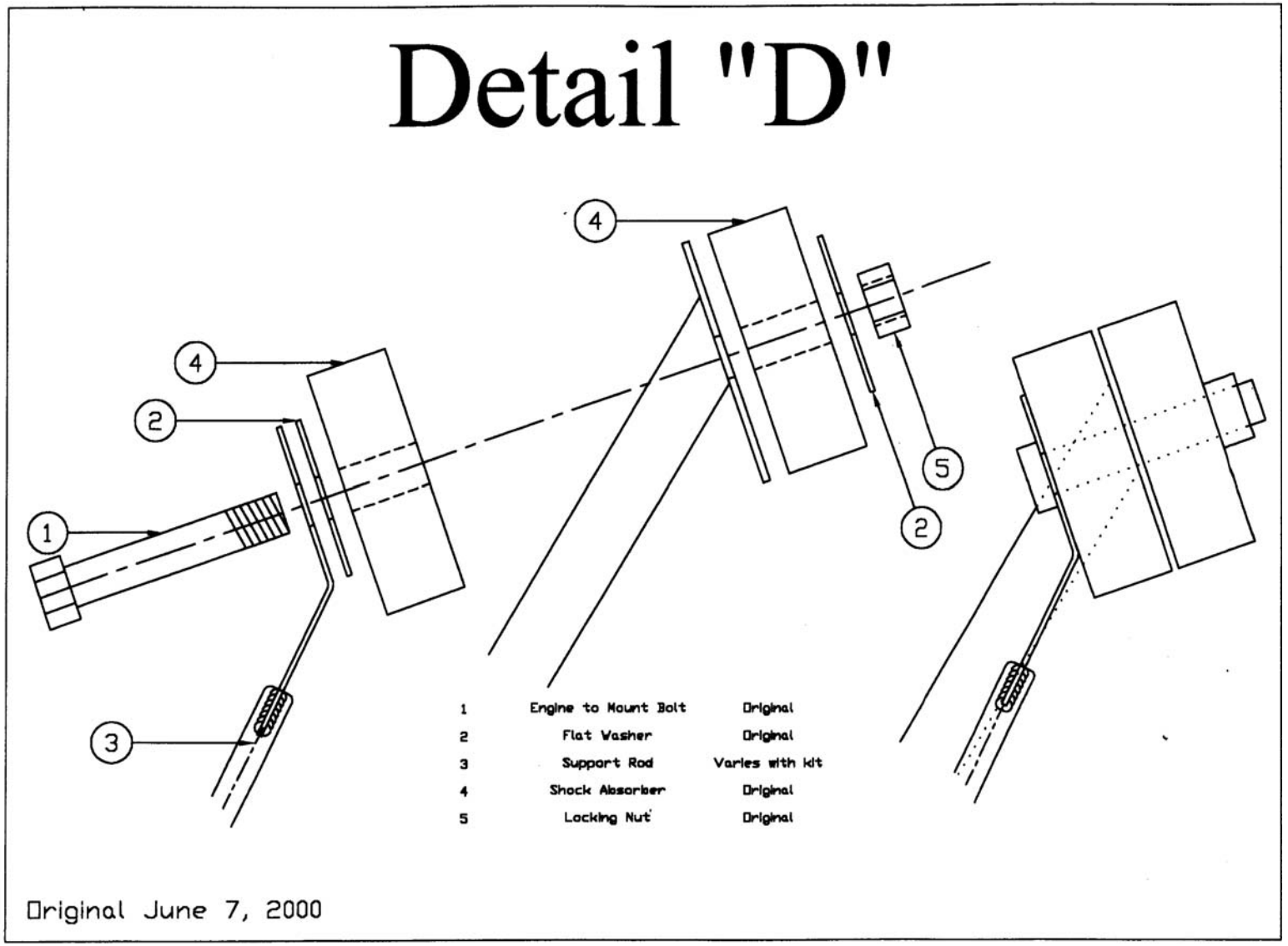
**DETAIL B**


DETAIL B
AN4C5
AN960C416
AN960C416
AN310C4
MS24665-153
EQUIVALENT HARDWARE MAY BE USED THROUGHOUT

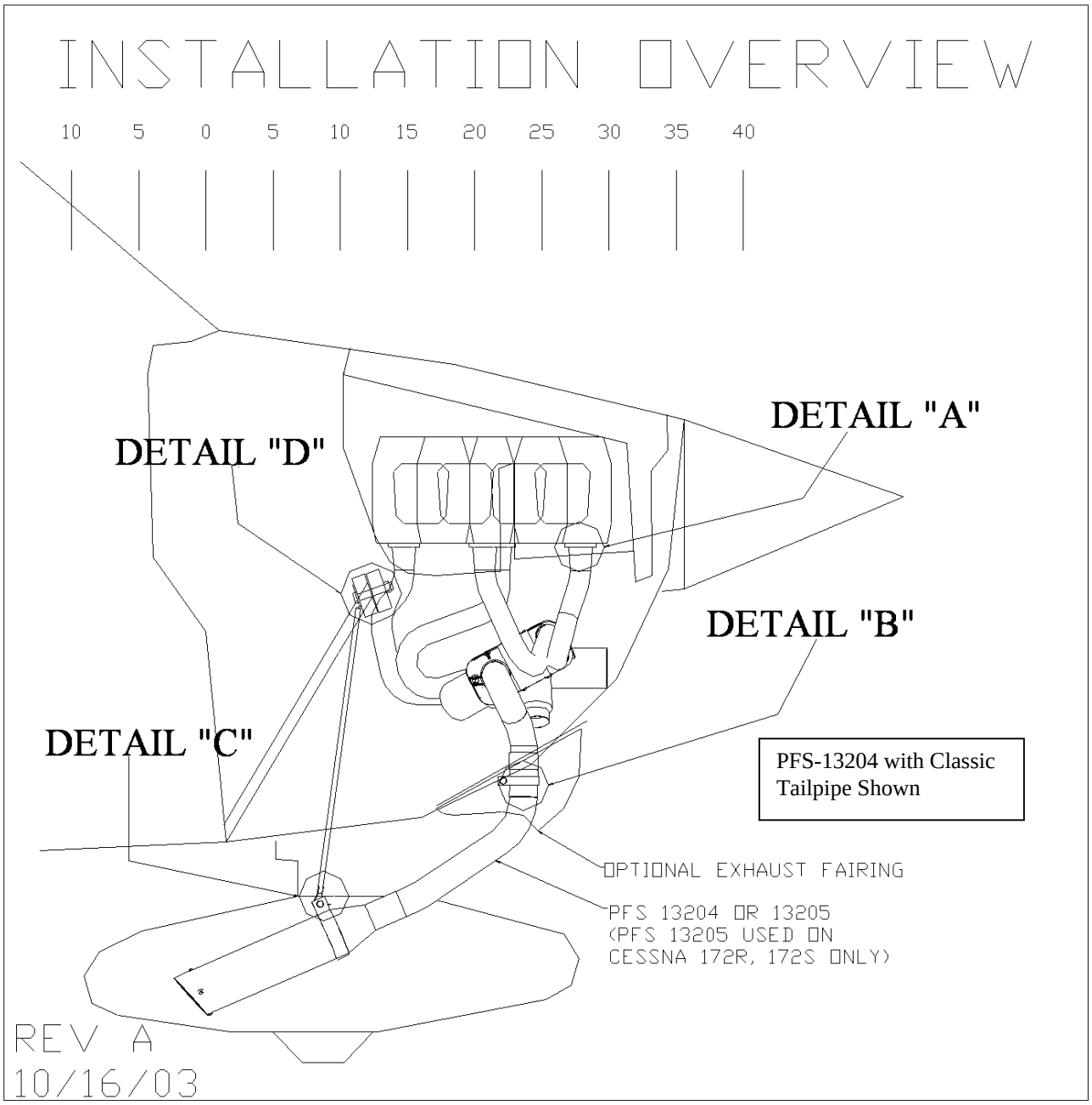
**DETAIL C**


DETAIL C
SUPPORT ROD
AN960C416
AN960C416
AN310C4
AN4C5
DO NOT SPLIT TABS
MS24665-153
8030
EQUIVALENT HARDWARE MAY BE USED THROUGHOUT

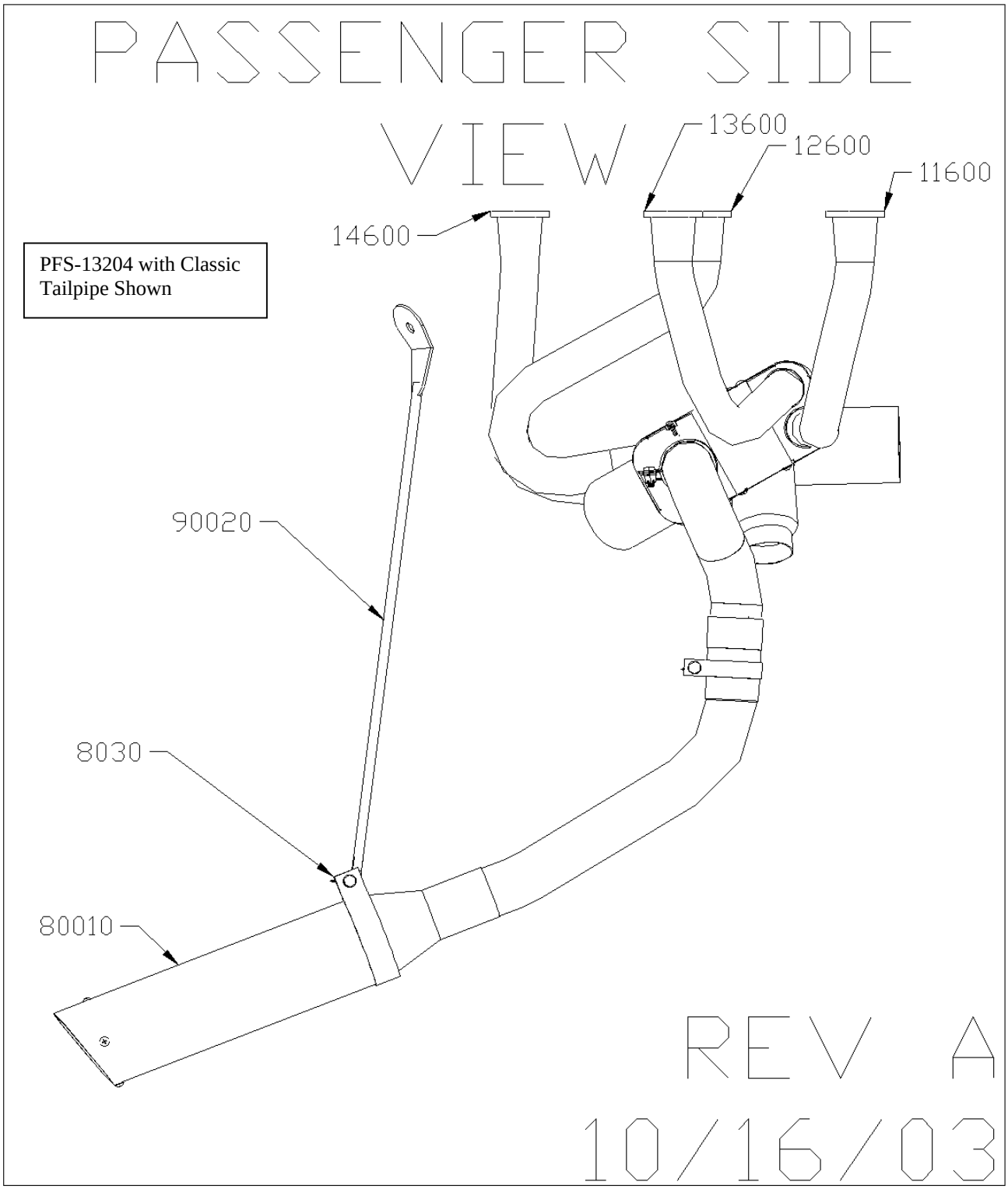
## DETAIL D


Detail "D"
4
2
1
3
4
5
2
1 Engine to Mount Bolt Original
2 Flat Washer Original
3 Support Rod Varies with kit
4 Shock Absorber Original
5 Locking Nut Original
Original June 7, 2000

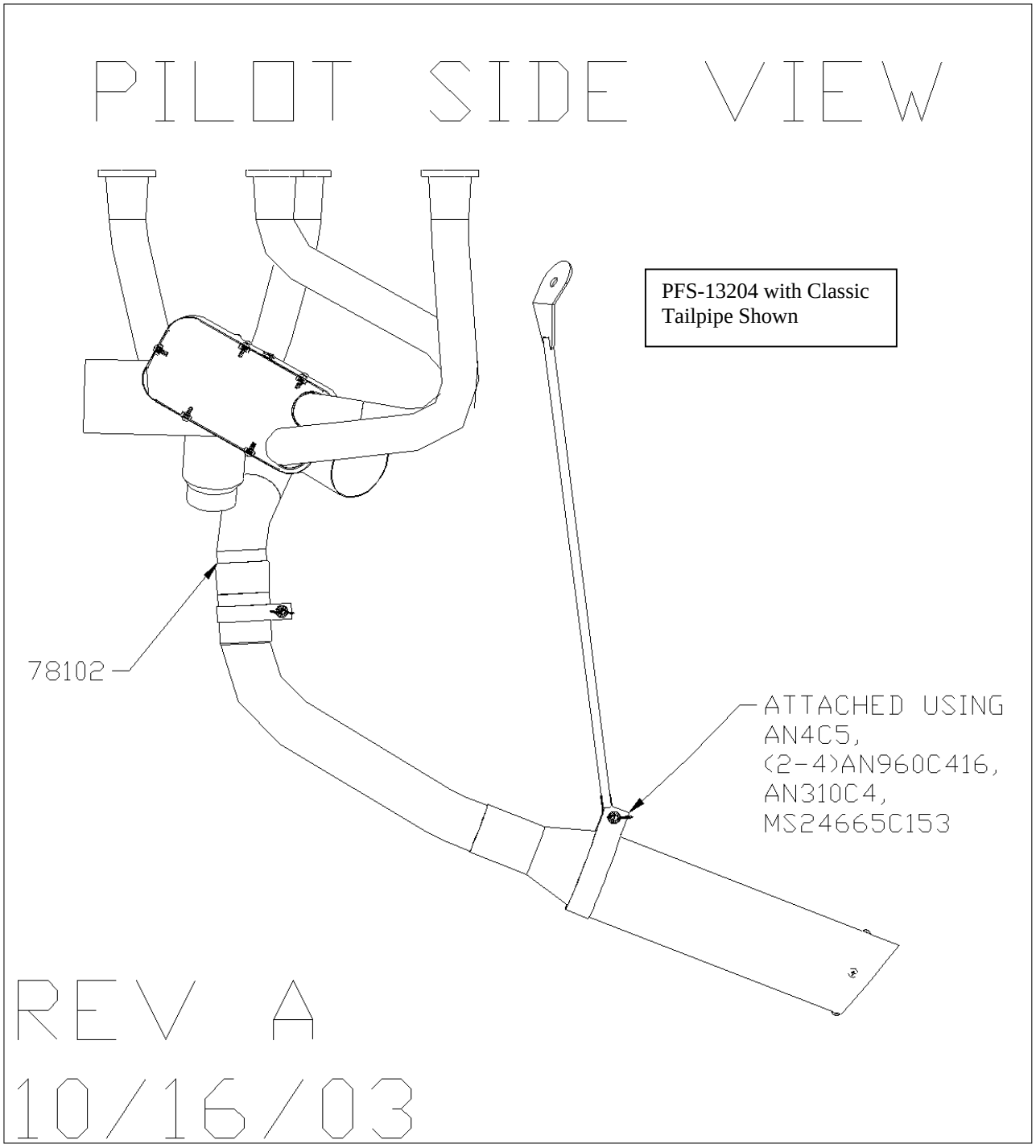
# INSTALLATION OVERVIEW - CLASSIC



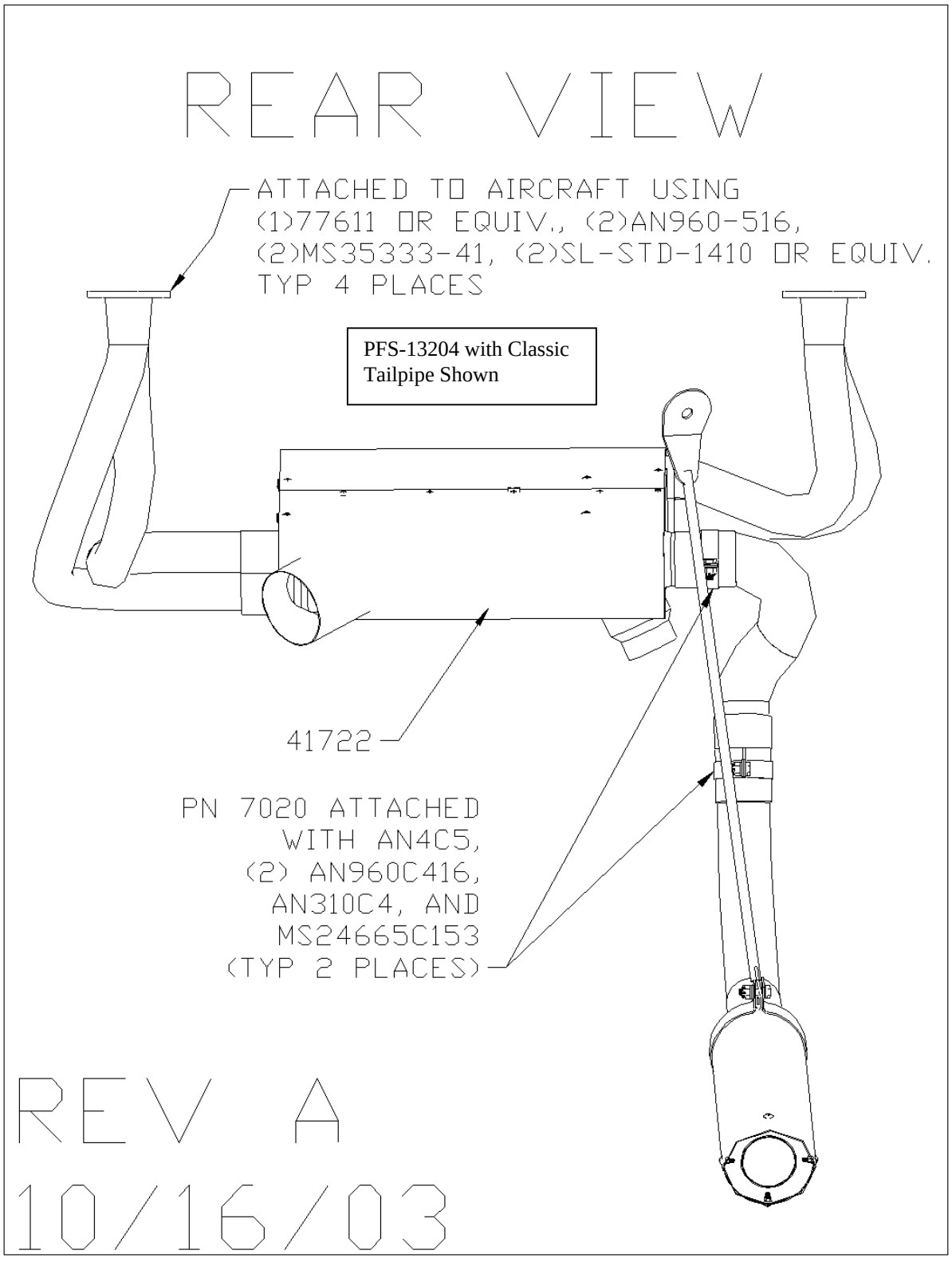
# PASSENGER SIDE VIEW - CLASSIC



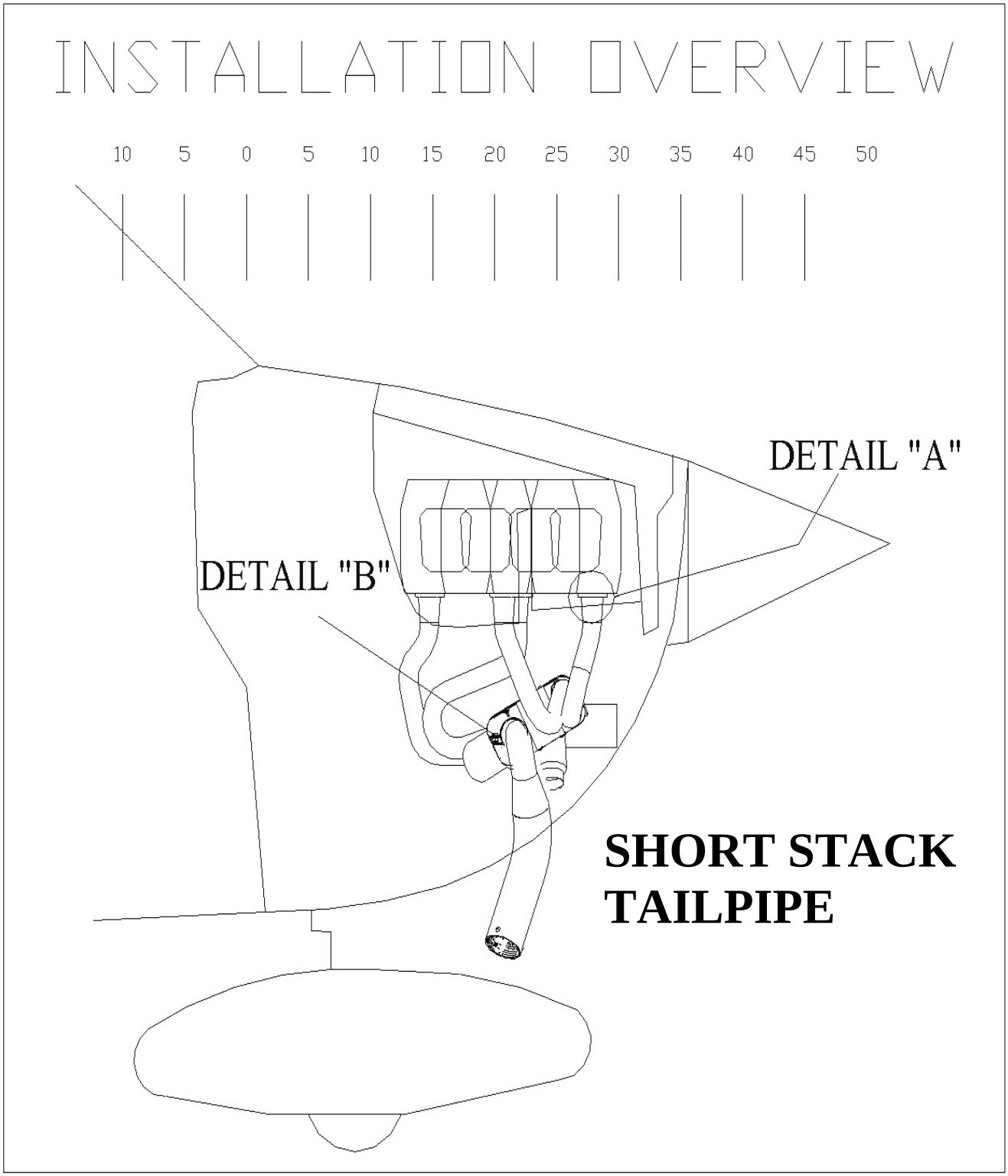
# PILOT SIDE VIEW - CLASSIC



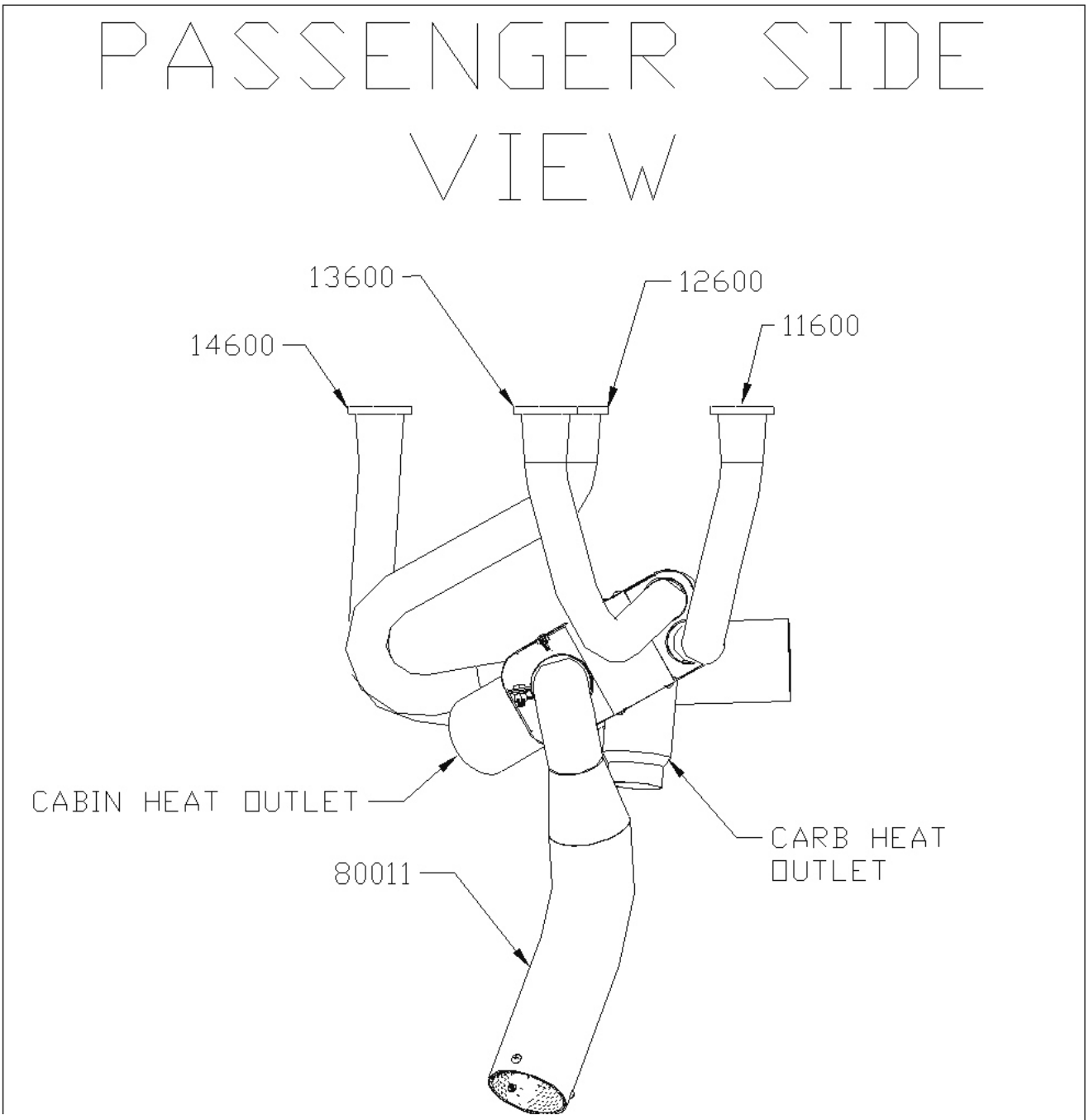
# REAR VIEW - CLASSIC



# INSTALLATION OVERVIEW – SHORT STACK



## PASSENGER SIDE VIEW – SHORT STACK



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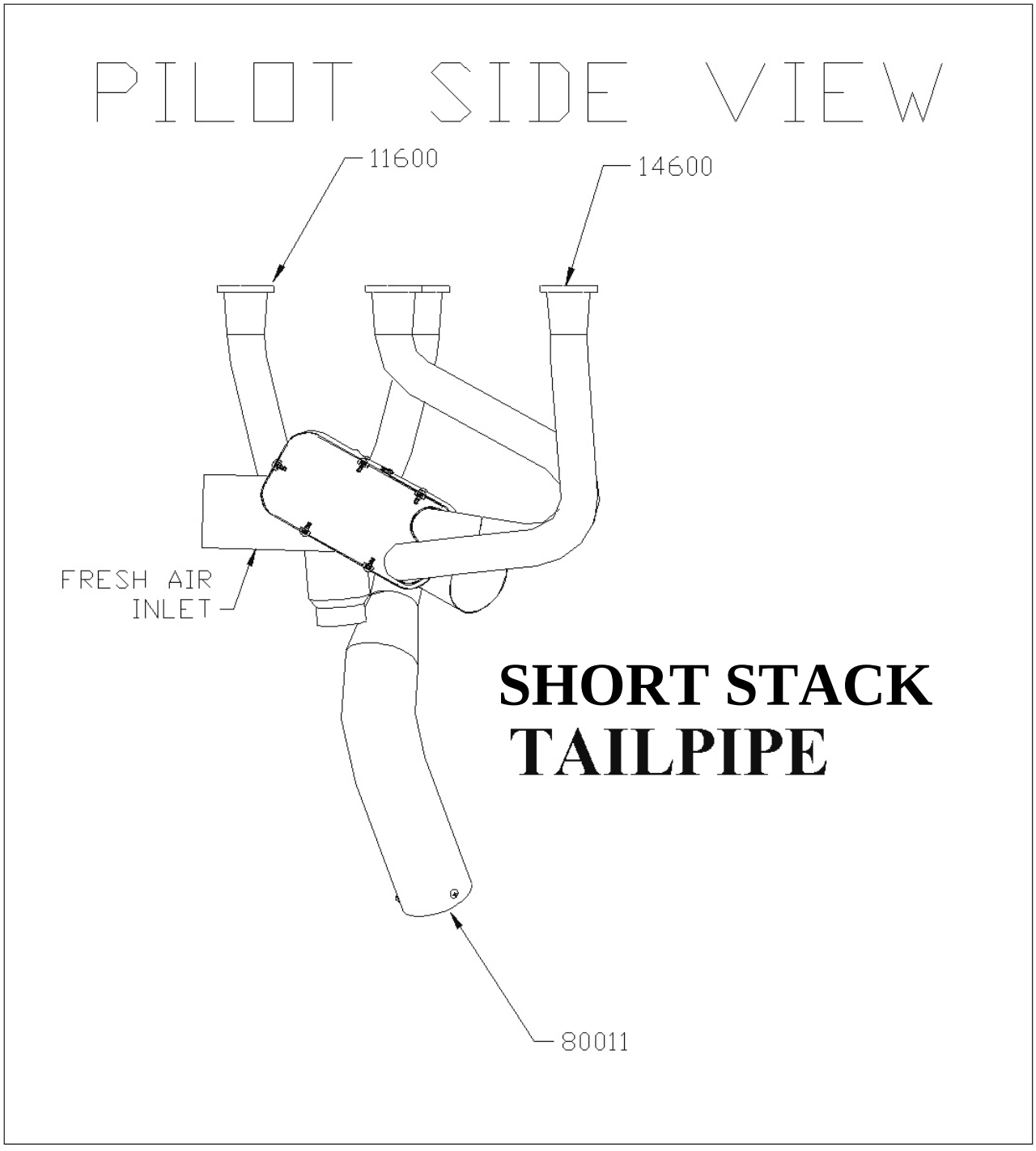
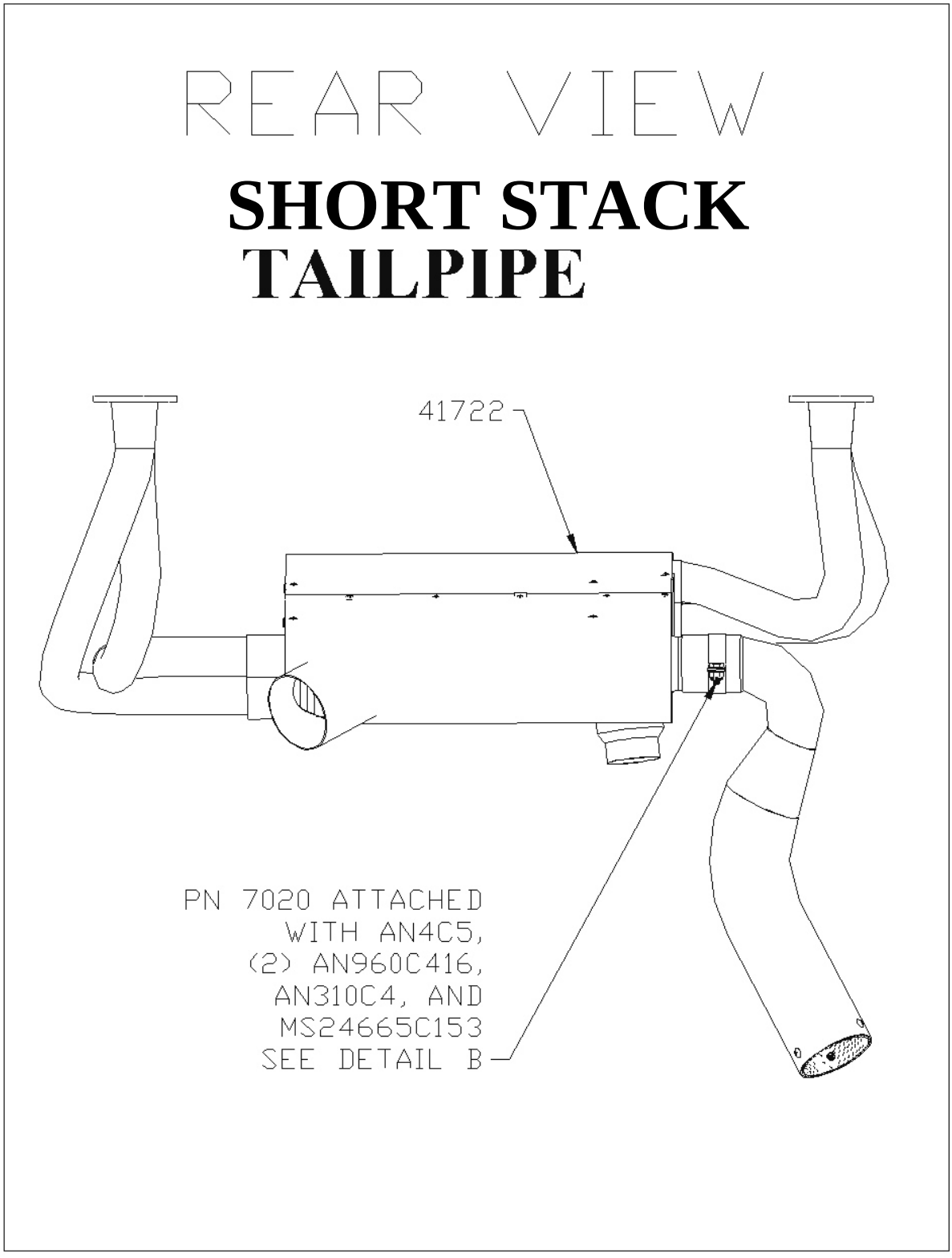


## REAR VIEW – SHORT STACK



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

# Supplemental Type Certificate

*Number* SA01801AT

*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 therefor as specified hereon meets the airworthiness requirements of Part* 3 and part 36 *of the* Civil Air and CFR 14 *Regulations.*

*Original Product - Type Certificate Number :* 3A12 A4EU 3A17

*Make :* Cessna; Cessna-Reims Aviation

*Model :* 172 , A-H; 172 I ; 172 K-N, P;
172Q , 172R, 172S; F172D thru F172H ;
F172K-N, F172P; 175, 175A, 175B, 175C

*Description of Type Design Change:*
**For the Cessna 172 airplane models incorporating Lycoming O-320 engines:** Modification of the standard exhaust system as documented in Laminar Flow Systems Installation Instructions Document, "Laminar Flow System Extractor Exhaust System" Revision A, dated, November 20, 1998 and Technical Drawing List, Book No. PFS-B-800, dated, November 16, 1998 or per Power Flow Systems, Inc. Installation Instructions Document PFS-0058-00, Rev. A, dated October 5, 2001 and Master Drawing List, Report No. PFS-0032-00, Rev. IR, dated August 10, 2000, or later FAA approved revisions.
**For the Cessna 172 and 175 airplane models incorporating Lycoming O-320 ,O-360 or IO-360 engines:**
Modify the standard exhaust system as document in Power Flow Systems, Inc. Installation Instructions Document PFS-13250-00, Rev B, dated, December 9, 2002 and Master Drawing list PFS-13240-00, Rev, IR, dated October 3, 2002, or later FAA approved revisions.

*Limitations and Conditions:* 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*

*Date of application :* May 30, 1997

*Date of issuance :* January 07, 1999

*Federal Aviation Administration.*

*Date reissued :* June 22, 2000 ; October 16, 2003

*Date amended :* July 24, 2003; August 22, 2003;
September 14, 2004

*By direction of the Administrator*

Christina L. Mark
*(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.*



*This certificate may be transferred in accordance with FAR 21.47.*