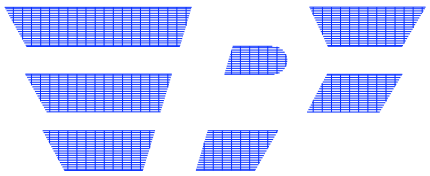


PRECISE FLIGHT, INC.
63120 POWELL BUTTE ROAD
BEND, OR 97701
800- 547-2558 Ext. 32

STANDBY VACUUM SYSTEM MODEL VI UPGRADE KIT

- Shuttle Valve S/N 14928 & Subsequent -

(MANUAL VALVE SVS-1 & 1A)

PRECISE FLIGHT, INC.
63120 POWELL BUTTE ROAD
BEND, OR 97701
800- 547-2558 Ext. 32

SVS VI - Shuttle Valves S/N 14928 & Subsequent (Manual Valve SVS-1 & 1A)

T A B L E O F C O N T E N T S

SVS VI - Shuttle Valves S/N 14928 & Subsequent (Manual Valve SVS-1 & 1A)

PRECISE FLIGHT, INC.
63120 POWELL BUTTE ROAD
BEND, OR 97701
800- 547-2558 Ext. 32

SVS VI - Shuttle Valves S/N 14928 & Subsequent (Manual Valve SVS-1 & 1A)

LIST OF ACTIVE PAGES

ORIGINAL		ADDED PAGES					
PAGE	REV	PAGE	REV	PAGE	REV	PAGE	REV

PRECISE FLIGHT, INC.
63120 POWELL BUTTE ROAD
BEND, OR 97701
800- 547-2558 Ext. 32

R E V I S I O N S

REV NO.	PAGE	DESCRIPTION	DATE	NAME
-	ALL	Initial Release	1/07/00	STP

PRECISE FLIGHT, INC.
63120 POWELL BUTTE ROAD
BEND, OR 97701
800- 547-2558 Ext. 32

SVS VI - Shuttle Valves S/N 14928 & Subsequent (Manual Valve SVS-1 & 1A)

1. GENERAL INFORMATION

1.1. INTRODUCTION

This manual contains information regarding the physical, as well as the electrical and mechanical installation information pertaining to the Precise Flight **Standby Vacuum System.**

NOTE: THIS DOCUMENT MUST BE KEPT WITH AIRCRAFT RECORDS

1.2. PRODUCT DESCRIPTION

The Standby Vacuum System consists of:

1. Mechanical Check Valve - Shuttle Valve
2. Vacuum Operated Switch
3. Instrument Pump Warning Indicator
4. Manual Valve
5. Placards

The Standby Vacuum System connects easily to the aircraft powerplant intake manifold, electrical system and the instrument vacuum supply.

In the event of an engine driven vacuum pump failure, The Precise Flight Standby Vacuum System allows the use of engine intake vacuum, in conjunction with a flight tested operating procedure, to supply vacuum to the primary aircraft instruments. This vacuum supply is limited by the difference between ambient air pressure and intake manifold pressure.

NOTES: The system is for emergency use only and is most effective below 8000 ft ASL. The system will not run a vacuum powered autopilot.

SVS VI - Shuttle Valves S/N 14928 & Subsequent (Manual Valve SVS-1 & 1A)

1.3. TECHNICAL CHARACTERISTICS

Weight:	**2.4 pounds** **1.09 kilograms**
Dimensions:	**6.0 in. W, 2.0 in. D, 2.27 in. H** **15.24 cm W, 5.76 cm D, 5.76 cm H**
Operating Voltages	**12 or 28 VDC**

1.4. FACTORY SETTINGS

Vacuum Switch	**3.5 in. Hg.**

1.5. UNITS AND ACCESSORIES SUPPLIED

Standby Vacuum System Kit includes:

a) A Shuttle Valve S/N 10243 and Subsequent (2 Way Check Valve)
b) AN fitting AN844-6D or AN840-6D
c) Copy of the Standby Vacuum System Supplemental Type Certificate
d) Flight Manual Supplement and Placard

1.6. INSTALLATION APPROVAL BASIS

The person, who performs or supervises the update of the Standby Vacuum System, is required to prepare a logbook signoff. If there is no previous logbook signoff or FAA Form 337 referencing the original installation of the SVS-1 or SVS-1A, a new FAA Form 337 must be prepared. See Figure 1-1 for a Sample Description of Work Accomplished. Data that can be used as a basis for approval for return to service are:

A. AC 43.13-1B; Acceptable Methods, Techniques and Practices, Aircraft Inspection and Repair.
B. AC 43.13-2A; Acceptable Methods, Techniques and Practices, Aircraft Alterations
C. FAA approved Manufacturer's Installation Instructions.

Equipment installation procedures do not differ significantly among various aircraft. The installation and operation of the Standby Vacuum System does not materially affect the aircraft operation or performance.

PRECISE FLIGHT, INC.
63120 POWELL BUTTE ROAD
BEND, OR 97701
800- 547-2558 Ext. 32

SVS VI - Shuttle Valves S/N 14928 & Subsequent (Manual Valve SVS-1 & 1A)

The Sample Description of Work Accomplished (**Figure 1-1**) is suggested language provided as a convenience to the installing agency. The information and wording should be modified to correctly describe the particular installation.

Entries for this installation should be entered in both the aircraft and engine logbook.

Precise Flight Inc. can assume no responsibility for the alteration of the airframe, electrical, or powerplant system.

8. Description of Work Accomplished

(If more space is required, attach additional sheets. Identify with aircraft nationality and registration mark and date work completed.)

A. The following components were installed:

PRECISE FLIGHT STANDBY VACUUM SYSTEM UPDATE, MODEL SVS V*I*, P/N 04055, S/N _____
Installed IAW Engine STC (Lycoming SE1799NM or Continental SE1780NM) and STC SA_____NM

B. The Shuttle Valve Unit was installed in (*position in the aircraft*) according to instructions in the PRECISE FLIGHT INSTALLATION MANUAL STANDBY VACUUM SYSTEM UPDATE MODEL SVS VI, P/N 08074 dated (*insert current revision date of manual*), and guidance in FAA Advisory Circulars 43.13-1B, chapter 11, and 43.13-2A, Chapter 1 & 2.

C. Complete ground and flight operational tests were performed according to the PRECISE FLIGHT STANDBY VACUUM SYSTEM MODEL SVS VI INSTALLATION MANUAL P/N 08074 date ____ . The equipment performed satisfactorily and did not adversely affect existing components or systems in the aircraft, as required by FAR 23.1301, FAR 23.1431. The operating placard was filled out and placed on the aircraft instrument panel next to the Aux. Vac. Valve.

D. The aircraft equipment list was revised to reflect these changes; weight and balance data was revised and placed in the aircraft records. A Precise Flight Inc. Standby Vacuum System Aircraft Flight Manual Supplement dated _____ was placed in the aircraft.

FIGURE 1.1 - FAA FORM 337 / LOGBOOK SIGNOFF

1.7. AIRCRAFT CERTIFICATION

The Precise Flight Standby Vacuum System is approved by the following Supplemental Type Certificates:

Original STC's for SVS-1 and 1A Installations:

STC #	AIRCRAFT MAKE/MODEL	DATE OF ISSUANCE
SE1779NM	Lycoming Engines	December 28, 1982*
SE1780NM	Continental Engines	December 28, 1982*
SA2160NM	Beech 35 – B33	November 7, 1983*
SA2161NM	Beech V35B	November 7, 1983*
SA2162NM	Cessna T210L	November 7, 1983*
SA2163NM	Cessna U206G	November 7, 1983*
SA2164NM	Cessna 180Q	November 7, 1983*
SA2166NM	Cessna 177	November 7, 1983*
SA2167NM	Piper PA-28R-201T	November 7, 1983*
SA2168NM	Mooney M20K	November 7, 1983*

* - Or Later Approved Revisions

2. INSTALLATION

2.1. GENERAL

The Precise Flight Standby Vacuum System should be updated according to this manual and AC 43.13-1B and -2A. This section contains interconnect diagrams, and other information pertaining to a Standby Vacuum System Update. These instructions are for the purpose of upgrading an SVS I or SVS IA to SVS VI.

2.2. UNPACKING AND INSPECTION

Exercise care when unpacking the equipment. Make a visual inspection of the unit for evidence of damage incurred during shipment. If a claim for damage is to be made, save the shipping container to substantiate the claim. The claim should be filed with the Transportation Company. Retain the container and packaging material after the equipment has been removed, should equipment storage or reshipment become necessary.

2.3. MECHANICAL INSTALLATION

Listed below are considerations to be examined before updating the Standby Vacuum System Model SVS VI. Close attention to these suggestions will assure optimum performance when completed.

CAUTION: Before you begin the Update be absolutely certain that the aircraft that is being modified is equipped with an Engine Driven *Vacuum Pump* and not an Engine Driven *Pressure Pump*.

2.3.1. Mechanical Update - Shuttle Valve Installation

A. Remove the old Shuttle Valve.

B. Install the supplied Hose Barb Fitting (and supplied Angle Fitting if necessary) into the end of the new Shuttle Valve. Use Teflon Tape to prevent leaks. See **Figure 2-1**.

C. Install the new Shuttle Valve. Be sure that the location provides adequate protection from heat and is a stable and suitable location.

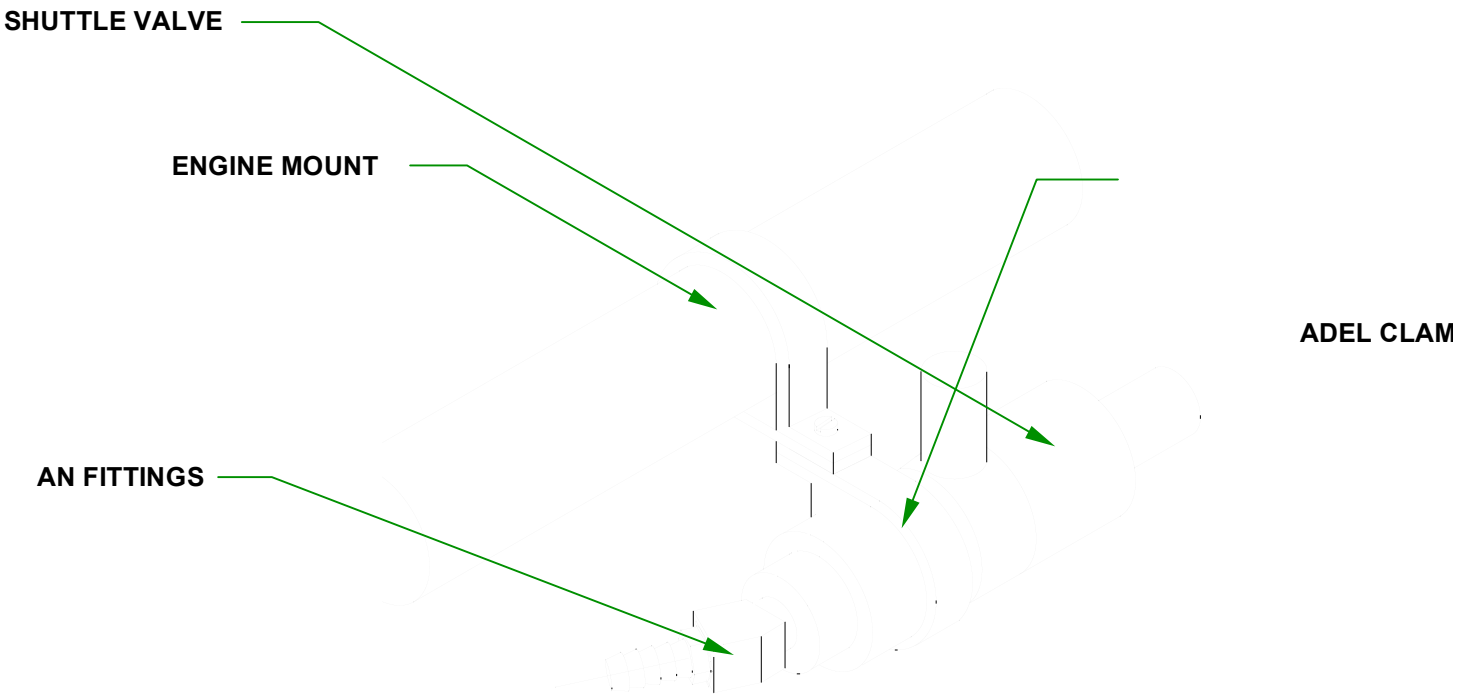


FIGURE 2-1 – TYPICAL SHUTTLE VALVE INSTALLATION

SVS VI - Shuttle Valves S/N 14928 & Subsequent (Manual Valve SVS-1 & 1A)

D. Re-connect the vacuum hose between the end fitting of the Shuttle Valve and the intake of the Engine Driven Vacuum Pump. Re-connect the existing Vacuum hose to the center fitting of the shuttle valve. Inspect and clean all tubing before final installation. If the aircraft vacuum system does not use 5/8" Dia. Vacuum hose, the kit contains a set of 1/2" Hose Bibs (P/N 20020) and 3/8" Hose Bibs (P/N 20030). The Hose Bibs must be bonded to the Shuttle Valve with Locktite Depend Adhesive.

Note: To Insure proper bonding, follow the directions included with the adhesive.

2.3.2. Mechanical Installation - Saddle Fitting (Neoprene Intake Cuff)

A. Check to make sure that the existing Saddle Fitting is properly aligned. See **Figure 2-2**.

B. **Caution: A Gasket should not be installed under the saddle fitting when using a neoprene intake cuff.**

C. Check fitting and intake hole with a probe, (Drill Bit 0.234 dia.) to insure an unobstructed manifold tap.

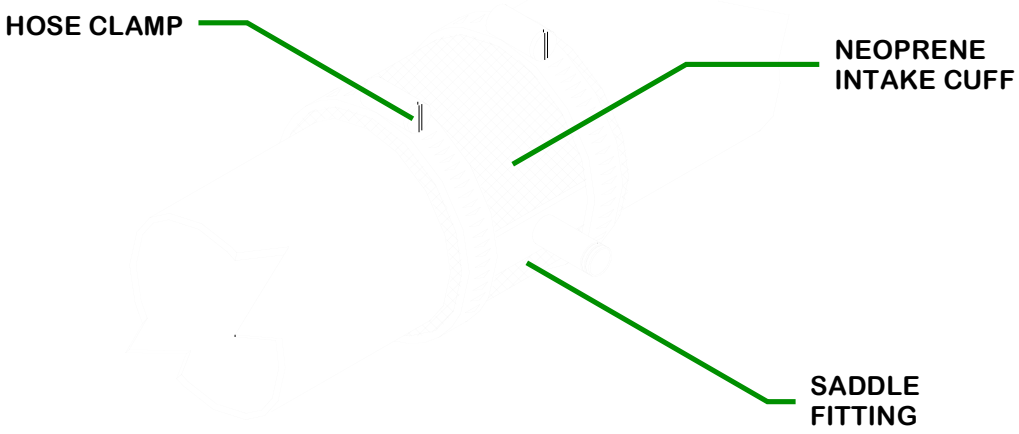


FIGURE 2-2 - SADDLE FITTING INSTALLATION

2.3.3. Mechanical Installation - Saddle Fitting (Lycoming W/O Intake Cuff)

A. Check to be sure that the Saddle Fitting and Gasket are aligned properly on the intake manifold. **Caution: A Gasket should be installed under the saddle fitting when connecting directly to the intake manifold.**

B. Check fitting, gasket, and intake hole with a probe, (Drill Bit 0.234 dia.) to insure an unobstructed manifold tap.

C. Be sure that both sides of the Saddle Fitting Gasket (P/N 10050) are coated with gasket cement or Dow RTV.

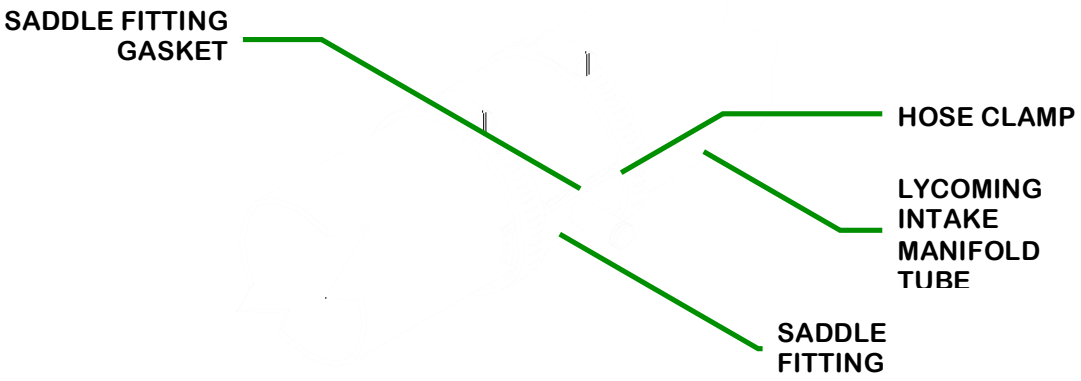


FIGURE 2-3 - SADDLE FITTING INSTALLATION (LYCOMING W/O CUFF)

3. TESTING

3.1. INSTALLATION TESTING (REQUIRED IF ALTITUDE POWER CHART DATA IS MISSING!)

During the first test run-up of the aircraft powerplant, check the vacuum system for any leaks, loose hose clamps, or possible chafe points. Secure as needed. Be sure to protect the system neoprene hoses from the engine exhaust system. After completing installation, check engine idle mixture setting

Important: The following flight test shall be performed in VFR conditions only; Flight conditions that do not require the use of the aircraft gyro system for aircraft control.

The following test procedure will evaluate the installation in the aircraft:

1. Disconnect the vacuum pump supply line to the Precise Flight SVS Shuttle Valve. Install an appropriate gyro hose type filter in such a manner to prevent engine driven vacuum pump contamination.
2. Install a clean piece of tape over the exposed hose bib on the Precise Flight Shuttle Valve.
3. Follow SVS VI operating instructions; check the operation of the SVS VI at each altitude listed on the applicable SVS Placard for the type of engine/propeller combination.
4. If level flight at altitude is difficult to maintain at a power setting consistent with the aircraft instrument requirements, indicate that the Standby Vacuum System is N/A (Not Available). The SVS Placard should indicate maximum Continuous RPM to maintain the aircraft primary instrument vacuum requirements or 3.5 in.

5. Reassemble vacuum pump to the Shuttle Valve - **ENSURE NO CONTAMINATION**
6. Perform a ground engine run-up to check vacuum pump operation and return aircraft to service.

Select appropriate chart (See Example in Appendix A - Altitude Power Chart) and following SVS VI testing procedures, record the RPM or manifold pressure that is required to maintain a minimum level of vacuum for each altitude listed to provide adequate instrument operation. Enter these values on the appropriate placard and in the Aircraft Flight Manual Supplement. Attach the placard (P/N 40030) in a conspicuous location on the instrument panel near the Aux. Vac. System Valve.

EXAMPLE: 2000 Ft. 2200 RPM or 19" of manifold pressure, Vacuum 3.5 in. Hg minimum.

3.2. TROUBLESHOOTING

The troubleshooting suggestions described in this guide will be with the engine driven vacuum pump disconnected and the pump protected with an intake filter

Locating a vacuum problem requires using a (step-by step) process of elimination, beginning at the engine intake manifold vacuum source

NOTE: A vacuum test gauge of known accuracy is required to check vacuum problems. Aircraft instrument gauges, both manifold pressure and vacuum, have been known to be inaccurate.

3.2.1. Low Vacuum Reading

A. The most common cause of low vacuum readings is due to improper alignment of the SVS Saddle fitting and the engine intake manifold. To Check alignment, carefully push the shank of a 15/64 (0.234") dia. drill through the saddle fitting and into the intake manifold.

NOTE: It may be necessary to leave the drill shank in the saddle fitting & manifold when tightening the hose clamps. This will insure proper alignment between the saddle fitting & manifold. Be sure to remove the drill after tightening the clamps.

B. All vacuum hoses and lines should be as straight as possible. Avoid sharp bends and kinks, since tight bends, especially in hoses, may cause excessive in-line airflow restriction.

C. It may be necessary to establish proper vacuum and airflow. Consult the pressure altitude chart.

D. Faulty aircraft gauges, loose, worn or cracked hoses and fittings, leaking induction system pipe joint coupling hoses, or induction pipe to cylinder gasket are other known causes of low vacuum.

NOTE: To check for this condition, disconnect the instrument vacuum lines from the regulator and cap off.

E. Restrictions between engine induction system and vacuum regulator. Regulator setting too low.

F. Basic engine condition (compression), ignition timing.

G. SVS VI manual control valve not fully opened

H. Verify the accuracy of aircraft vacuum and manifold gauges

I. Connect a test gauge to the hose at the vacuum regulator with a tee fitting and one port capped off. With the engine at idle (on the ground) there should be around 15 in. Hg of vacuum available at sea level. Remove the cap on the tee fitting and connect to the regulator valve. With the engine idling the indicated vacuum will be the regulated vacuum. An erratic gauge needle or light will indicate an engine problem or sticky vacuum regulator.

NOTE: It will be necessary to take into consideration the loss of atmospheric pressure at higher altitudes.

3.2.2. Erratic Vacuum Gauge Readings

A. Excessive contamination in the vacuum regulator filter.

B. Malfunction of the vacuum regulator.

C. Engine conditions, such as sticking valves, which will cause erratic vacuum readings.

3.3. CONTINUED AIRWORTHINESS

3.3.1. At ANNUAL Intervals.

3.3.1.1. INSPECTION

A. Inspect Manual Valve, Insure that the valve rotates through 90 degrees and operates freely.

B. Inspect vacuum lines - look for wear, chaffing and deterioration. Replace if required

C. Inspect Saddle Fitting

1.) Inspect to insure gasket is securely cemented to engine intake tube (Lycoming Engine w/o Intake Cuff)

2.) Inspect gasket for deterioration and replace if required. (Lycoming Engine w/o Intake Cuff)

3.) Check security of Saddle Fitting and insure hose clamps are tight and the Saddle Fitting seated

4.) Check alignment of the Saddle Fitting using an alignment probe (drill 0.234" dia.) to insure an unobstructed vacuum tap.

NOTE:

Disassembly of the Vacuum Lines and adding a Filter for the System Check requires a logbook entry as well as a Return to Service Entry after the test is completed.

3.3.2. At BIENNIAL Intervals (Every other year)

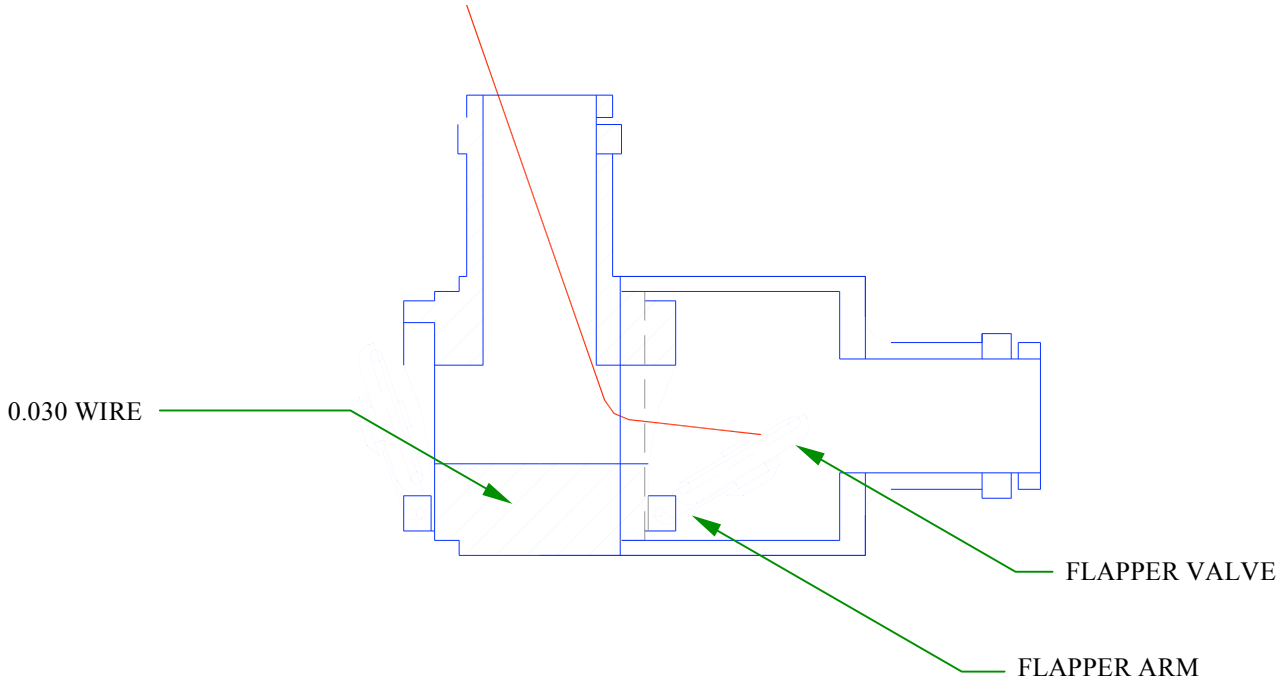
3.3.2.1. SHUTTLE VALVE TEST (S/N 14928 & Subsequent- noted by two protrusions on the flapper valve to limit flapper valve rotation& Stainless Steel Rivet)

A. Remove the Shuttle Valve from the aircraft.

B. On a workbench, utilizing a wire, flashlight. Check that the spring returns the flapper valves to the closed position

C. If the valves do not close - contact **Precise Flight Inc.** for a new Shuttle Valve.

D. Reinstall a serviceable Shuttle Valve in the Aircraft.



4. OPERATION

4.1. NORMALLY ASPIRATED OPERATION

In the event of an engine-driven vacuum pump failure, the Precise Flight Standby Vacuum System (SVS VI) will use engine intake manifold vacuum to operate attitude and directional gyro instruments. **CAUTION: The SVS VI is not designed, or approved to operate an autopilot.**

The SVS VI will operate satisfactorily with a vacuum differential of 3.5 in. Hg between atmospheric pressure and the intake manifold vacuum. A reading of 3.5 in hg on the aircraft vacuum gauge will indicate this differential. Precise Flight recommends a minimum of 3.5 in. Hg to maintain an emergency supply to the primary vacuum gyroscopic instruments. Check aircraft flight manual for manufacturer recommendations.

The SVS VI is designed to operate adequately two vacuum powered instruments at a 3.5 in. hg differential. It is designed for Emergency Use Only, and to allow the pilot to land at the first available airport after the failure of the primary vacuum source.

IMPORTANT: THE SVS System is not suitable for autopilot vacuum supply. Per the system Flight Manual Supplement the Autopilot is to be turned off before operating the SVS system.

4.2. TURBOCHARGED ENGINE OPERATION

All turbocharged, single engine aircraft powerplants have vacuum in the intake manifold until the turbocharger begins to supply pressurized air to the engine. When the turbocharger is operating engine intake manifold pressure will exceed ambient air pressure. The engine manifold is pressurized. An example would be the Mooney 231.

The Mooney 231 is equipped with a turbocharger and when taking off utilizing a power setting of 40 in Hg., the intake manifold is pressurized to provide additional power to the engine. Once the aircraft is at cruise speed and power at 8000 ft to 10,000 ft altitude the power setting is reduced to 27 in. Hg. and the engine intake manifold is pressurized by the turbocharger. The Precise Flight Standby Vacuum System relies on the difference between the outside ambient air pressure and the intake manifold pressure, power settings on a turbocharged engine will have to be reduced to allow proper Standby Vacuum System operation.

Once a turbocharged aircraft is at altitude, and has a vacuum pump failure, a slow and safe descent to landing, using low power settings, will be necessary to effectively operate the SVS system. In the Mooney 231 you can cruise with 18.5 in. Hg. at 8,000 ft. MSL, which will provide the required vacuum to maintain primary gyro instruments. On final approach you will have the best possible vacuum. The aircraft engine, turbocharged or not, is developing more vacuum than the primary gyro instruments need and the vacuum regulator will keep the system within limits.

SVS VI - Shuttle Valves S/N 14928 & Subsequent (Manual Valve SVS-1 & 1A)

The SVS VI is designed to operate adequately two vacuum powered instruments at a 3.5 in. hg differential. It is designed for Emergency Use Only, and to allow the pilot to land at the first available airport after the failure of the primary vacuum source.

IMPORTANT: THE SVS System is not suitable for autopilot vacuum supply. Per the system Flight Manual Supplement the Autopilot is to be turned off before operating the SVS system.

PRECISE FLIGHT, INC.
63120 POWELL BUTTE ROAD
BEND, OR 97701
800- 547-2558 Ext. 32

5. DOCUMENTATION

5.1. DOCUMENTATION

To ensure technical updates and notifications, fill out and return the warranty document.

5.2. RETURN AUTHORIZATION

In order to expedite repair of units; call the factory for a return authorization number before returning equipment for service.

5.3. WARRANTY SERVICE

Precise Flight warrants products in accordance with the warranty statement in effect at the time of equipment registration. All repairs are performed at the factory. Contact Precise Flight Inc. for a warranty / return authorization. Authorized warranty work performed by the dealer will be limited to removal and re-installation of units on an exchange basis. Precise Flight Inc. will bear the cost of warranty returns both ways via **UPS** surface delivery only. Precise Flight reserves the right to use reconditioned parts in repairing the product or to use reconditioned units as warranty replacements.

For technical information and service, call 1-800-547-2558.

6. APPENDIX A

6.1.1. PARTS LIST