RAPCO, inc.
REPLACEMENT AIRCRAFT PARTS CO.

DRY AIR PUMP REMOVAL & INSTALLATION INSTRUCTIONS AND TIPS

FAA-PMA Approved New
FAA Approved Overhaul

This document shall be given to the aircraft owner after installation. You must enter the following in the logbook after installation:

"FAA-P-8740-52 safety warning given to aircraft owner"

This document is for reference only.
Refer to OEM service instructions

WARNING: Flying IFR without an operating backup system for this pump may result in death, bodily injury or property damage. Follow TC holders published safety warnings.

Air Pump Removal Instructions

Step 1

Remove pump from accessory drive on engine.

Discard accessory pad gasket.

Clean & inspect drive pad.

Inspect accessory drive seal for oil leaks. (Important! Remove and replace seal if there are signs of visible oil around the seal area) (See Fig. 1)

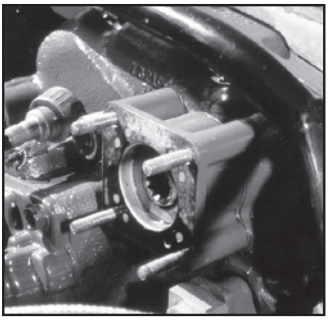
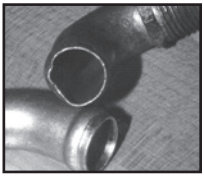


Figure 1

Step 2

Remove fittings from pump using caution to not bend or twist. If fittings are damaged or twisted, replace with new Rapco, Inc. fittings where applicable.



Step 3

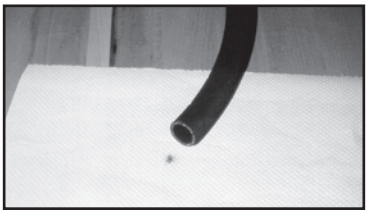
Clean and blow out all pneumatic lines (Inlet & Outlet) to remove additional carbon build up in system.

Caution! Insure that all lines to be blown out are not connected to the flight instruments as to not damage them.

Any hoses or lines that can be removed from the aircraft should be cleaned thoroughly (See Fig. 2A) and reinstalled properly. (See Installation, next section)

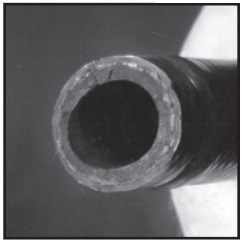
It is very important to remove any carbon or other particles from the system so they do not fail the new pump upon start up!

Figure 2A



Inspect hoses for dry rot and deterioration, along with any rubber shavings collected inside of the hose. If any of the above is found -REPLACE HOSES.(See Fig. 2B& 2C)

Figures 2B & 2C



Air Pump Installation Instructions

Step 1

Remove and replace all pneumatic filters in the system (inlet filters, inline filters & regulator air filters). (See Fig. 4) See Rapco, Inc. filter cross-reference for proper Rapco filter use.

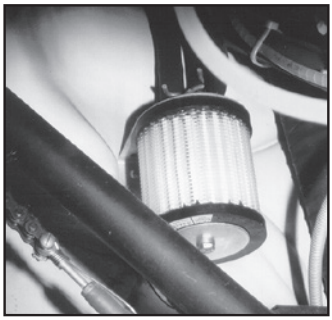


Figure 4

Step 2

Reinstall all hoses and fittings properly, using hose clamps to insure that there are no suction/pressure leaks in the system. (See Fig. 5) Loose hose clamps or hoses will indicate low suction/pressure in the system. Note: All rubber hoses should be inspected & replaced per the aircraft maintenance manual.

Figure 5

Step 3

Install inlet & outlet pump fittings. Spray fitting threads with a small amount of silicon spray lubricant & **allow to dry** prior to threading into the air pump. This will allow adequate sealing of the pipe threads without harm to the pump.

DO NOT use teflon tape or any other type of thread sealant. This will damage the internal pump rotor & vanes and void your warranty!

Step 4

Install new air pump using new accessory drive pad gasket Rapco part #AS3491-01. (Supplied with Rapco pump) Replace lock washers with new. Tighten nuts in accordance with manufacturer's requirements. **CAUTION! DO NOT DROP THE PUMP.**

Step 5

Reinstall inlet and outlet hoses on pump. Work the hose over the fitting carefully. Use caution to not shave any rubber off the hose into the pump area. Install hose clamp. Run engine & check suction/pressure. Adjustment of regulator may be required. Refer to aircraft maintenance manual.

Step 6

Complete Warranty Registration card and return, or fill out online at www.rapcoinc.com

Step 7

Give this entire manual and a copy of the warranty to the aircraft owner.

Step 8

Complete airframe log book entry for all work completed to include the following:

"FAA-P-8740-52 safety warning given to aircraft owner"

On Aircraft Air Pump Maintenance Tips:

All pumps have been pre-run (run-in for break-in period) to insure proper suction/ pressure output and flow.

Note: If other maintenance (involving engine degreasing) is being performed it is important to cover the pump with a rag or plastic bag to prevent any solvents from seeping into the pump.

Pumps equipped with wear inspection port should be maintained in accordance with Rapco Service Letters: RASL-001, RASL-002, or RASL-006. All are available at www.rapcoinc.com.

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Introduction

You fly in actual instrument weather conditions and make enough approaches to keep “current,” take your flight review from a good instructor, know the “Normal” and “Emergency” procedure sections of your Pilot’s Operating Handbook, and feel you are qualified to cope with any emergency. Are you?

Maybe not. The NTSB has reported air pump/system failure as a factor in an average of two accidents per year over the past eight years. About one-half of the reported cases involved other overriding factors such as loss of control with a back-up electrical gyro available, non-instrument rated pilots flying in instrument weather conditions, and departing with pneumatic systems known to be inoperative.
The most disturbing factor is that the remaining half - an average of about one accident per year - occurred to instrument-rated pilots who recognized the pneumatic system failure, flew on partial panel in instrument weather conditions for 30 to 45 minutes, and then lost control during high task loads, such as during an instrument approach. Another common denominator was that all aircraft involved were high performance, retractable gear, single engine aircraft.

Lessons Learned

The lessons are clear. The first is that loss of a pneumatic system in actual instrument conditions, without a back-up system, is an emergency that may become life-threatening unless the airplane can be flown by partial panel into visual weather conditions. It may not be possible to do so, either due to weather conditions or lack of pilot practice with partial panel flying.

An airplane with a single pneumatic system with no back-up system, or back-up instruments, should not be flown in any IFR conditions that do not provide for quick access to VFR conditions. IFR flight “on top” of cloud layers with good ceiling underneath should create minimal problems with pneumatic system failure, but flying in actual IFR with low ceilings and visibilities underneath sets the stage for serious difficulties.

The second lesson is that any airplane used regularly in IFR weather should be equipped with either a back-up power source, such as dual pneumatic systems, or back-up electrically powered gyroscope instruments. Although it is legal to fly single engine aircraft without dual power sources for gyroscope instruments, and the exposure rate to accidents due to pneumatic system failure while in actual instrument weather is low (1 accident for each 40-50,000 general aviation instrument flight plans filed), prudence suggests that a back-up power source is good insurance against being forced to fly partial panel in adverse weather without sufficient practice.

Gyroscopic Instrument Power

Normal instrument flight relies in part on three gyroscope instruments: an attitude indicator (artificial horizon), a heading indicator (directional gyro, or “DG”) and a turn and slip indicator (“needle and ball,” or “turn and bank,” or “turn coordinator”).

These gyroscopic instruments may be powered by pneumatic (vacuum or pressure) or by airplane electrical systems. Which power source is used for which instruments may vary in the same make and model of airplane, depending on use intended at time of manufacture or modifications made after manufacture.

The most common arrangement for single engine airplanes without back-up instrumentation, or systems, is a single vacuum system which powers the directional and attitude gyroscope instruments. The other gyro instrument, the “turn and bank” or “turn coordinator” is usually electrically driven.

The gauge on the instrument panel may be marked as either a “suction gauge,” a “vacuum gauge,” or a “pressure gauge,” and indicates in inches of mercury. The correct operating range (around 4.5” to 5.5” HG.) is given in the Airplane Flight Manual (AFM) or Pilot’s Operating Handbook (POH) for each airplane. Some airplanes also have warning lights when the vacuum or pressure is out of tolerance.

Pneumatic systems, like other mechanical systems, can malfunction suddenly or slowly. A slow decrease in gauge indication may indicate a dirty filter, dirty screens, sticking

regulator, worn out air pump or leak in the system. Zero pressure could indicate a sheared pump drive, pump failure, a collapsed line, or a malfunctioning gauge. Any operation out of the normal range requires immediate attention by a mechanic.

A complete pneumatic loss is noticeable immediately on the gauge or within minutes by incorrect gyro readings. A slow deterioration may lead to sluggish or incorrect readings which may trap a pilot who is not constantly cross-checking all instruments - including the vacuum or pressure gauge.
An additional factor involves an initial lack of recognition of the cause of the conflicting instrument indication which develops when one instrument, usually the attitude indicator, malfunctions. Although possibly proficient in flying “partial panel,” many pilots are not trained or skilled in deciding to revert to a partial panel scan unless an instructor or safety pilot has forced the scan by covering the attitude indicator. It is important for pilots to scan all instruments whenever conflicting information develops, and not attempt to make control inputs on the basis of the attitude indicator alone.

Once the all-important first step of recognition of the need for partial panel scan is accepted, it is also helpful to remove the malfunctioning instrument from the scan, usually by covering it with a disk or piece of paper.

The possibility of pneumatic system or gyroscope instrument failure is the reason every instrument instructor drills students on partial panel flying without reference to gyroscope heading and attitude instruments. It is very rare that the failure itself results in a fatal accident, but it can set the stage for one if the pilot is not proficient in partial panel flying and the failure occurs during instrument flight conditions.
Tips for Survival

Know Your Airplane

Every pilot should know the instrument power sources for each airplane flown, and particularly know the consequences of loss of any source of power, air or electrical, or loss of any instrument, and be prepared to cope with the loss.

Know Yourself

Airplanes can be flown safely with loss of one or more gyroscopic instruments. Every instrument rated pilot demonstrated the ability to do so prior to receiving the rating. The problem is that many never practice the skill and only a few have ever practiced in turbulence, as it seems an unlikely need in routine operations.

Professional pilots who are required to take semiannual simulator training practice a lifetime of emergencies each training session although they rarely encounter emergencies in daily operations. Most general aviation pilots remain “current” by flying in the system and may rarely face or practice emergency situations. For most pilots, continued flight in IFR conditions with failed gyro heading and attitude instruments is a high work load situation that could lead to a fatality.

If You Are Not Instrument Rated

If you are not instrument rated and inadvertently encounter instrument weather, the 180 degree turn is usually the best course of action. If your pneumatic driven gyro instruments fail, it is still possible to make a 180 degree turn by using the turn and bank (or turn coordinator), magnetic compass and clock. Likewise, a descent through clouds to VFR conditions can be made using the turn indicating instrument. These procedures may be tailored to each airplane type and model and should be demonstrated by and practiced with an instructor. It may be too late to learn them when faced with actual need. Avoid conditions that risk encountering instrument weather.

If You Are Instrument Rated

If you are instrument rated and gyro instruments fail or mislead, do not be afraid to ask for help. ATC personnel know where to find better weather and are able to give “no gyro” heading directions. The whole system - radar, weather reports, communication, and personnel - is instantly available to assist you.

Do not try to be a “hero” and continue on bravely as if loss of pneumatic power is no big deal. It can be a serious emergency unless you have maintained high proficiency in partial panel flying.

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Also, cover the dead or lying instruments. Most partial panel practice is done with covered instruments, but in real cases the artificial horizon will be sagging and giving erroneous information that your instincts want to accept as correct. Autopilots that use these instruments as sensors must be turned off immediately. Note: Again, you need to know your aircraft systems thoroughly, so that you will know how a pneumatic system failure affects other equipment.

Finally, if your airplane has no back-up capability, be very cautious in the type of IFR you fly. Solid IFR from takeoff to touchdown can be very difficult on partial panel.

Back Up - Better Way

If your airplane does not have a back-up, or stand-by system, and if you use your airplane for IFR flight, consider a back-up or stand-by pneumatic system. Several manufacturers offer a variety of alternate systems that will supply vacuum or pressure if the engine driven pump fails. While the chances of pneumatic system - or pneumatic driven instrument - failure while in actual IFR conditions has been demonstrated to be small, those same statistics also demonstrate that the cost of a stand-by system is far less than the too often fatal results of not having a back-up.

Federal Aviation Administration
Aviation Safety Program (AFS-820)
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Contact your local FAA Fligh Standards
District Office's Safety Program Manager
for more safety information

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