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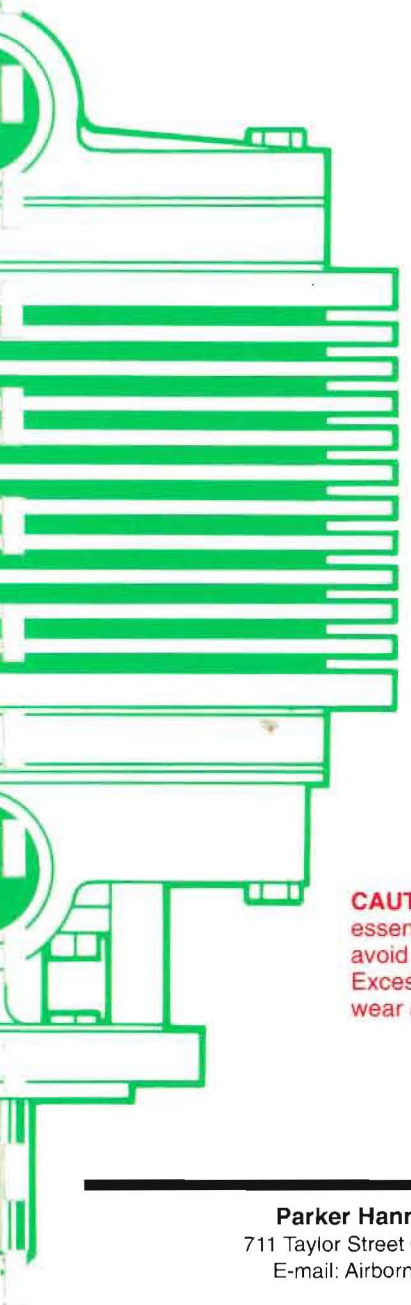

Dry Air Pump
and Pneumatic System

Maintenance Instruction Manual

Sections:

CAUTION: Proper pneumatic system maintenance is essential to assure satisfactory system operation and avoid dry air pump loading in excess of design limits. Excessive dry air pump loading will cause excessive wear and premature failure.

Parker
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1 System Maintenance

Engine Cleaning Precautions

WARNING: FAILURE TO PROTECT THE PNEUMATIC SYSTEM COMPONENTS FROM CONTAMINATION BY ENGINE CLEANING SOLVENTS MAY RESULT IN PREMATURE PUMP FAILURE.

Prior to washing down the engine compartment, the following precautions must be taken to assure expected service life of the pneumatic system components.

A. Dry Air Pump Coupling

The seal on the engine drive side of the pump in the front frame of the housing behind the coupling is designed to keep out foreign material such as dirt, dust and light fluid. However, fluid under high pressure can be forced by the seal and enter the pump.

1. Protect the coupling area between the pump mounting flange and the pump housing by wrapping a protective covering around that area during engine cleaning (Fig. 1).

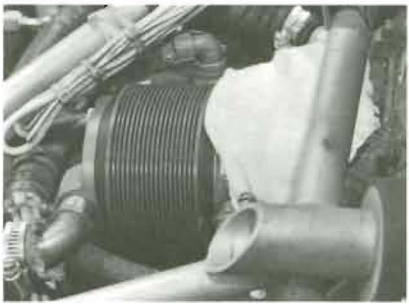

Fig. 1 Coupling Protected

Fig. 2 Covered Inlet Filter

B. Dry Air Pump Fittings

1. Before washing the engine off, check the pump fittings for looseness of the threaded fittings. Fluid can seep through loose threads and enter the pump. Refer to Section 3, Dry Air Pump Installation in this Booklet.

C. Vacuum/Pressure Regulator Filter

1. Whether the inlet air filter is behind the engine on the rear firewall or in the forward engine compartment, make sure to wrap a protective covering around the vacuum regulator filter or pressure system pump inlet filter (Fig. 2).

D. Hoses

1. Vacuum Systems — Plug the end of the pump discharge hose or fitting and flag it with a red "Remove Before Running Engine" tag.

2. Pressure Systems — Inspect hose from inlet filter to pump. If there are holes, cracks or other damage which could allow solvent leaks, replace the hose. Refer to Section 3, Dry Air Pump Installation in this Booklet.

E. Deice And Regulator Valves

1. Protect deice valves, relief valves, and pressure regulators located in the engine compartment with some type of protective covering prior to engine cleaning.

   CAUTION: DO NOT BLAST THE AIR PUMP COUPLING AREA OR OTHER PNEUMATIC SYSTEM COMPONENTS WITH CLEANING SOLVENT UNDER HIGH PRESSURE.

   DO NOT ALLOW PROTECTIVE COVERING AROUND THE COUPLING OR FILTERS TO BECOME SATURATED WITH SOLVENT.

After Engine Cleaning

1. Remove all protective coverings, red tags, and plugs from hoses before running engine.
2. Verify that the area in and around each valve is clean, dry and free of cleaning fluids before running engine.
3. Replace all system filters before running engine if contaminated. (See Filter Change Schedule.)

Inspection and Maintenance Procedure

Check all pneumatic components, including gyro, deice, and door seal valves as well as pneumatic autopilot system components.
Contamination, restrictions or malfunctions in the system can overload the pump and cause premature pump failure. Replace defective and contaminated components before replacing pump.

1 System Maintenance

A. Filters

CAUTION: CHANGE ALL THE FILTERS IN THE SYSTEM. FAILURE TO CHANGE ALL THE FILTERS MAY RESULT IN PREMATURE PUMP FAILURE.

Dirt clogged filters reduce the flow of air through the air pump resulting in increased pump operating temperatures that cause higher pump wear rates. Dirty filters will affect regulator function and cause low vacuum/pressure gage indications.

Filter Change Schedule

Air filters must be replaced at each air pump replacement and at the intervals specified below.

Frequency	Vacuum System	Pressure System
100 hrs./ annually	Vac. Rg. Garter Filter (P/N B3 - 5 - 1)	Pump Inlet Filter (P/N B3 - 5 - 1) (P/N D9 - 14 - 5) (P/N D9 - 18 - 1)
500 hrs./ annually	Central Gyro Air Filter (P/N D9 - 14 - 5) (P/N D9 - 18 - 1) (P/N 1J10 - 1)	Inline Gyro Filter (P/N 1J4 - 4) (P/N 1J4 - 6) (P/N 1J4 - 7)

B. Oil Leaks

Oil contaminated carbon components in the pump will cause erratic vacuum or pressure gage indications and generate high pump operating temperatures.

CAUTION: FAILURE TO CORRECT OIL LEAKS MAY ALLOW OIL TO ENTER THE DRY AIR PUMP AND CAUSE PREMATURE PUMP FAILURE.

1. Inspect the area around the AND 20000 pump pad seal and lower surfaces of pumps for evidence of oil. If evidence of oil is discovered follow the instructions noted below:

   Problem: AND 20000 pad seal leaking.

   Corrective Action: Replace the AND 20000 pad seal in accordance with the engine manufacturer's recommended procedures.

   Problem: Pump mounting gasket leaking.

   Corrective Action: Install new Airborne pump mounting gasket.

   Problem: Oil in the pump's drive coupling area.

   Corrective Action: Replace the pump. Install the new pump as outlined in Section 3, Dry Air Pump Installation in this booklet.

2. Inspect the engine compartment for evidence of any other oil leaks, i.e., fittings, hoses, gaskets, etc. Replace or repair as required.

C. Dry Air Pump Fittings

Loose or damaged fittings can reduce air pump life through leakage or by restricting airflow.

1. Inspect fittings for looseness or damage which may leak or restrict airflow.

2. Fittings with stripped, burred, or truncated threads, or fittings that are twisted, bent or kinked must be replaced. Also replace fittings that have rounded wrench flats. Reinstall fittings as outlined in Section 3, Dry Air Pump Installation in this Booklet.

   NOTE: MS fittings are not recommended due to excessive pressure drop.

D. Pneumatic System Hoses, Clamps and Hardware

Hoses and hardware should be inspected for condition, proper installation and freedom from debris, oil or solvents.

CAUTION: THIS STEP IS EXTREMELY IMPORTANT AFTER A PUMP FAILURE TO ENSURE THAT CARBON PARTICLES ARE REMOVED AND CONDITIONS WHICH CAN REDUCE PUMP LIFE ARE CORRECTED.

1. Check the condition of the hoses in the pneumatic system. If hoses are found to be hard, cracked, oil soaked or brittle, replace with new hose.

2. Remove hoses as required and clean them with vacuum or air pressure.

3. Inspect the inside of all system hoses to make sure they are free of all debris, oils, or solvents. Reinstall hoses as outlined in Section 3, Dry Air Pump Installation in this Booklet.

E. Regulators, Valves and Deice Valves

Regulators, valves and deice valves should be clean and oil-free, adjusted to proper settings necessary for optimum pump service life and operating within limits specified in the Aircraft Service/Maintenance Manual.

1. Check general condition of regulators and valves to insure they are clean and in airworthy condition. If solenoid equipped inspect wiring and electrical connections. Check for proper operation per the Aircraft Service/Maintenance Manual.
2. On all single and multi-engine deiced aircraft it is important to insure that the deice valve(s) are operating completely to the off position.

   NOTE: Field Service Reports have shown that some deice valves may stick in a partially closed position at completion of the deice cycle causing excessive pump back pressure and operating temperature which will lead to premature pump failure. This condition can exist when the deice system appears to be functioning properly.
3. Replace or repair malfunctioning and inoperative regulators and valves.

F. Manifolds/Check Valves

Synthetic rubber components in manifolds and check valves deteriorate with age causing a loss of the flexibility to fully seal against the valve seat. Extremely deteriorated valves may separate at the hinge rendering the manifold/check valve inoperative and possibly restricting downstream airflow.

SAFETY WARNING ⚠ : AN IMPROPERLY FUNCTIONING MANIFOLD CHECK VALVE COULD CAUSE LOSS OF THE DUAL AIR PUMP REDUNDANCY FEATURE.

1. In aircraft with two air pumps, check manifold/check valves for proper operation by providing vacuum or pressure, as required to one side of the manifold only. Then check the opposite side only. If both air source indicators (bullseyes) retract in either check, the manifold/check valve assembly is defective and must be replaced.
2. Check deice system check valves by providing low pressure to one side of the system with the opposite side disconnected at the pump. Replace all valves that leak.

G. Dry Air Pump Blast Cooling Tube

1. If the dry air pump is equipped with blast cooling, inspect for satisfactory condition of tubing/hose and associated hardware.

H. Dry Air Pump Coupling

CAUTION: Dry air pump coupling service life is six years at which time it should be replaced.

1. Check the drive coupling and make sure it is in satisfactory condition. Replace outdated drive coupling.

   Reference: Airborne Service Letter #17B dated 16 August 1991 or later revision and Airborne Coupling Kit Numbers:

   #350—200/211/212 pumps
   #351—230/240 pumps
   #352—430/440 pumps
   #353—830 pumps
   #354—840 pumps

System Check Out

The Airborne 343 Test Kit can be used to accurately check out the pneumatic system operation on both single and twin engine aircraft without running the engines. Test kit precision instruments pinpoint vacuum, pressure and component operating problems quickly, safely, and economically. Pneumatic system functions may also be tested while aircraft engines are running after the air pump has been installed, however, safety and accuracy will be compromised.

WARNING: THE DRY AIR PUMP CAN BE OPERATING IN AN OVERLOADED CONDITION EVEN WHEN PNEUMATIC SYSTEM OPERATION APPEARS SATISFACTORY IN AN ENGINE RUN-UP CHECK. PREMATURE PUMP FAILURE MAY RESULT.

NOTE: The aircraft instrument panel vacuum or pressure gage only measures instrument operating vacuum/pressure, not the pump operating vacuum/pressure. Pump operating vacuum/pressure can be measured by using the 343 Test Kit.

A. Gyro System

1. The vacuum or pressure instrument air gage should read in the middle of the green arc or approximately at the midpoint of pressure range specified in the Aircraft Service/Maintenance Manual.

2. There should be less than 1.5" Hg drop in vacuum/pressure between the pump and gyro instruments in single engine aircraft (less than 2" Hg drop in twin engine aircraft).

   NOTE: If this check is made with the engine running, engine speed must be 1500 RPM or higher.

B. Deice System

1. Check for normal operation to manufacturer's specifications.
2. Deice timer should inflate boots for approximately six (6) seconds. Inflation time in "pressure dependent" deice systems will vary but should be less than 6 seconds for each segment of a complete deice cycle.

   NOTE: During deice systems check with engines running, engine speed must be a minimum of low cruise RPM.

C. Inflatable Door Seals

1. Check for normal operation within limits specified in the Aircraft Service/ Maintenance Manual.

   For optimum pump life, the pneumatic system should inflate the seal and stabilize without excessive recycling.

D. Pneumatic Autopilots

1. Check autopilot operation to Aircraft Service/Maintenance Manual or applicable STC'D supplement.
2. For optimum pump life, autopilot regulators, servos, and system filters must be maintained and adjusted in strict accordance with manufacturer's instructions.

E. Sub-systems

1. Check all other pneumatic sub-systems such as pneumatic camera doors, avionics cooling, etc. per the Aircraft Service/Maintenance Manual or STC'D supplement as applicable.

F. Dry Air Pump

1. After a satisfactory pneumatic system check out has been accomplished by using Airborne's 343 Test Kit, reinstall dry air pump/hoses as outlined in Section 3, Dry Air Pump Installation in this Booklet, and operate the pneumatic system by running the engine(s) to verify air pump performance.

2 Troubleshooting

When To Troubleshoot

Since aircraft pneumatics are an integrated system, the malfunction of one component may be caused by other component problems. Troubleshooting means looking beyond the symptoms to find the root causes. Pneumatic system troubleshooting should begin:

1. When a dry air pump fails early or when aircraft has a history of short pump life.
2. When pressure or vacuum gage registers above or below proper levels.
3. When gyro performance is erratic.
4. When deice, door seal or pneumatic autopilot system-malfunctions.

How To Troubleshoot

The Airborne 343 Test Kit can be used to safely troubleshoot vacuum systems (Fig. 3) and pressure systems (Fig. 4) in operation. For more detailed instructions about using the Test Kit for efficient problem diagnosis, see Airborne 343 Test Kit Instruction Manual. Testing can also be done while aircraft engines are running, however, safety and accuracy will be compromised.

Fig. 3 343 Vacuum

Fig. 4 343 Pressure

2 Troubleshooting

What To Troubleshoot

A. Premature Pump Failure

(Or an aircraft history of short pump life)

1. Check that the pump is the correct model for the engine and/or system. For a quick, in-field check, manually turn the propeller a few degrees in its normal direction of rotation and watch the AND 20000 pad drive. If the drive turns clockwise, a clockwise (CW) rotation pump is required. If it turns counterclockwise, a counterclockwise (CC) rotation pump is needed. Consult the airframe manufacturer's current parts manual, Airborne's Application List, or the PMA label on the pump box. If in doubt, call Airborne's Technical Services Hotline 1-800-382-8422.

2. Check for contamination, restrictions or malfunctions in the system that can overload the pump. Refer to Section 1, System Maintenance in this Booklet. Replace defective and contaminated components before replacing pump.

B. Improper vacuum/pressure gage indications

(High, low, erratic or no vacuum/pressure indicated)

1. Use the Airborne 343 Test Kit to check airflow through hoses and filters. Kinks in lines, deteriorated hoses, leaking hose connections and/or clogged filters reduce the flow of air in the system causing high or low vacuum/pressure indication and lead to premature pump failure.

2. Check for leakage from engine drive pad seals. Oil ingestion by the dry air pumps generate erratic vacuum/pressure gage indications and causes premature pump failure.

NOTE: Check regulator settings only after maintenance and troubleshooting cycles have been completed.

C. Excessive Gyro Precession

1. Excessive gyro precession, even to the point of tumbling can be caused by leaking lines or restricted airflow due to plugged filters or kinked lines.

NOTE: If the air filters are clean and there are no system restrictions or leaks, the problem is probably in the gyro itself.

D. Gage Indication Follows Engine RPM

1. Foreign matter on the regulator seat causes the gage to follow engine RPM. To correct this malfunction simply raise the diaphragm using a thin blunt tool, remove the contaminant, and reset the regulator to Aircraft Service/Maintenance Manual specifications.

2. If there is no foreign matter on the regulator seat use the 343 Test Kit to test the regulator function. Replace inoperative regulators.

   NOTE: Pumps that have been overhauled or are nearing the end of service life may also exhibit this malfunction.

E. Frequent Regulator Adjustments

1. Kinks in lines, deteriorated hoses, leaking hose connections and/or clogged filters will affect regulator function as well as limit airflow and result in premature pump failure.

   NOTE: Make regulator adjustments only after maintenance and troubleshooting cycles have been completed. Refer to Section 1, System Maintenance in this Booklet.

F. Deice Boot System Malfunction

(Deice boots fail to inflate or only partially inflate)

1. Check the deice valve(s). If inoperative or not functioning fully, repair or replace.

2. Check deice system check valves on the opposite side when boots fail to inflate on only one pump. Replace as necessary.

3. Check for air leaks in the system plumbing or in the boots themselves which can inhibit full inflation. Check for hairline cracks which may have developed in the boots allowing moisture to enter and freeze which creates air leaks. Replace plumbing or repair/replace boot as necessary.

3 Dry Air Pump Installation

When replacing a pump after a normal service history, make a routine maintenance check of fittings, hoses, filters, and regulating valves before installing the new pump. Replace a pump that has failed early only after system maintenance and troubleshooting cycles have been completed. Use of the Airborne 343 Test Kit for troubleshooting will insure that the new pump is installed in a clean, well maintained system, properly adjusted for optimum pump life.

NOTE: Refer to any Special Instructions included with the new pump prior to pump installation. These will include additional precautions and/or procedures relative to STC'D applications and applications having specific requirements that are not fully covered in this Instruction Booklet. For additional information call Airborne's Technical Services Hotline 1-800-382-8422.

A. Removal of Air Pump

1. Remove air pump from engine and discard old mounting gasket.
2. Remove fittings from pump. Retain fittings if they are serviceable and clean thoroughly before reusing. Discard twisted fittings and nuts with rounded corners.

B. Pad Inspection

1. Check the condition of the AND 20000 pad seal. If the seal shows any signs of oil leakage, replace the seal. Replace seal if there is any doubt as to its serviceability.

C. Installation of New Pump

NOTE: Keep pump ports capped until hoses are installed to prevent foreign materials from entering the pump.

CAUTION: Never install a pump that has been dropped. The internal parts may have been damaged causing immediate or premature failure.

1. Consult the airframe manufacturer's current parts manual. Airborne's Application List, or the PMA label on the pump box to verify that the pump is the correct model for the engine and/or system. If in doubt, call Airborne's Technical Services Hotline 1-800-382-8422.

2. Place the pump mounting flange in a jaw-protected vise, with the drive coupling downward. Protect the pump mounting flange with soft metal or wood (see Fig. 5).

   CAUTION: PUMP HOUSING SHOULD NEVER BE PLACED DIRECTLY IN A VISE, SINCE CLAMPING ACROSS THE CENTER HOUSING WILL CAUSE AN INTERNAL FAILURE OF THE CARBON ROTOR.

3. Spray the fitting threads with silicone and let dry (Fig. 6).

   CAUTION: DO NOT use teflon tape, pipe dope or thread lube.

4. Install fittings in the pump. Hand tighten.

5. Use a wrench to tighten fittings to desired position.

   CAUTION: DO NOT make more than one (1) turn beyond hand-tight position (Fig. 7) to position for hose alignment.

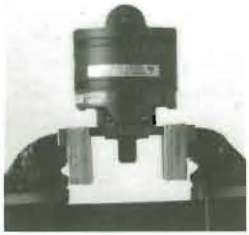

Fig. 5 Correct Position of Pump in Vise

Fig. 6 Proper Spraying of Fitting

Fig. 7 Tightening Fitting with Wrench

6. Install new pump mounting gasket (supplied with new pump).

7. Always replace ALL washers when installing a new pump. Tighten all four (4) mounting nuts to 70 in. lbs.

D. Inspection of Hoses

1. Before installing hoses, inspect the inside of the hose carefully to make sure it is clean and free of all debris, oils or solvents. Use vacuum or air pressure to clean the lines. Remove the hoses from the aircraft if necessary.

2. Clean the pump inlet and discharge lines. This step is particularly important in pressure systems. After a pump failure, carbon particles can pass in either direction, downstream as well as upstream.
3. Replace old, hard, cracked or brittle hose. Sections of the inner layers may separate, causing a pump failure.
4. Where hose clearance is tight, making it difficult to reinstall it onto pump fitting, spray the fitting at the hose end with silicone. Let dry, then install hose by pushing it straight on.

   CAUTION: DO NOT WIGGLE HOSE FROM SIDE TO SIDE. WIGGLING COULD CAUSE PARTICLES TO BE CUT FROM HOSE ID. THESE PARTICLES WOULD DAMAGE THE PUMP.

5. Make certain that hoses are connected to the correct fittings. Incorrect installation will cause damage to the gyro system.

E. Filters

CAUTION: CHANGE ALL THE FILTERS IN THE SYSTEM WHEN INSTALLING A NEW PUMP.

F. Final Check

After the air pump has been installed the pneumatic system should be operated by running the engine(s) to be certain that it is operating within the aircraft manufacturer's suggested limits in the corresponding Aircraft Service/ Maintenance Manual. If there are questions about the service/maintenance procedures, please call Airborne's Technical Services Hotline 1-800-382-8422.

4 Owner/Operator Safety Warning

It is essential that the Mechanic/Service Facility give the Vacuum/Pressure Gyroscopic Flight Instrument System SAFETY WARNING included with each air pump to the Owner/Operator of the aircraft in which the air pump is installed. FAILURE TO DO SO MAY RESULT IN DEATH, BODILY INJURY, OR PROPERTY DAMAGE.

For the most efficient and accurate system checks, system maintenance and troubleshooting of the complete pneumatic system should be performed with Airborne's 343 Pneumatic Test Kit available through your Airborne Authorized Distributor.

Airborne's 343 Test Kit is designed to help you accurately check out the pneumatic system operation on both single and twin engine aircraft without running the engines. Test kit precision instruments pinpoint vacuum, pressure and component operating problems quickly, safely and economically. The kit contains a manual with troubleshooting charts, diagrams and conversion kit information.

343 Test Kit

If there are any questions about the systems maintenance and troubleshooting procedures, call Airborne's Technical Services Hotline 1-800-382-8422.

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