CONVERSION AIR

ENGINEERING ORDER
98320603
PIPER 32 SERIES PA-32-301 R134A CONVERSION

Effectivity:

A/C MODEL	**A/C SERIAL NUMBER**
PA-32-301 "SARATOGA"	**32-8006001 AND UP**

CONVERSION AIR
PO BOX 7491
WACO, TEXAS 76714

ENGINEERING ORDER

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REV C AUGUST 16, 2017

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A	ADD BELT AND CLUTCH CONFG	01338	09/19/00	SS
B	UPDATE DOCUMENTATION	01785	05/20/14	SS
C	UPDATE DOCUMENTATION	01865	08/16/17	SS

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I. DESCRIPTION OF CHANGE

This set of instructions (Engineering Order) and the accompanying drawings furnish the data required to complete an R134a refrigerant conversion on the specified Piper 32 Series aircraft. The installation, when completed, will include an R134a compatible compressor, receiver dryer, and expansion valve. An installation kit (P/N 98320503-XXX) is part of this data package and contains all of the components necessary for the modification.

This modification is consistent with the Clean Air Act. Under this act the US Environmental Protection Agency (EPA) is required to establish a program to identify alternatives for class I and II ozone depleting substances. Under the EPA program, the only refrigerant which is acceptable for use in future new vapor cycle systems is HFC134a. On May 12, 1993 in the Federal Register (58FR.28094) the EPA proposed HFC134a for retrofitting of existing CFC12 vapor cycle systems.

This modification does not alter or disturb any electrical systems or operational functions of the vapor cycle system.

II. BACKGROUND INFORMATION/SYSTEM FUNCTIONALITY

The vapor cycle system (VCS) is composed of five major components. They are the evaporator, condenser, expansion valve, compressor, and the receiver dryer. During operation, the compressor, belt-driven pulley, compresses the refrigerant to a superheated gas. This gas then goes to the condenser where cooling air from a fan removes heat from the gas thereby condensing it to a liquid. The liquid is then stored in the receiver dryer until it is needed. The refrigerant flows to the expansion valve as a liquid. Here it is metered to the evaporator at a rate that will allow all of the liquid to evaporate and return to the compressor at a reduced pressure. The heat required for this evaporation is absorbed from the air passing over the evaporator cooling fins.

III. AIRCRAFT EFFECTIVITY

The following aircraft are affected by this modification:

Installation Kit 98320503-**001** by model and serial number:

PA-32-301 "SARATOGA"	**32-8006001 AND UP**

IV. INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

Retain this Engineering Order as a supplement to the Piper Maintenance Manual and Illustrated Parts Catalog. Maintain prescribed Piper Maintenance Schedule.

V. WEIGHT AND BALANCE

The incorporation of this kit does not affect the weight and balance of the aircraft. A new weight and balance report is not required for the aircraft.

VI. LINE REPLACEMENT UNITS

DESCRIPTION	PART NO.	QUANTITY
COMPRESSOR Conversion Air Source Control Drawing	MA006016-001	1 ea.
RECEIVER DRYER Conversion Air Source Control Drawing	EC006052-001	1 ea.
EXPANSION VALVE Conversion Air Source Control Drawing	EC006053-001	1 ea.
HOSE ASSEMBLY Conversion Air Source Control Drawing	98280649-001	1 ea.
HOSE ASSEMBLY Conversion Air Source Control Drawing	98280650-001	1 ea.
COMPRESSOR PULLEY/CLUTCH Conversion Air Source Control Drawing	EC006126-001	1 ea.
COMPRESSOR BELT Conversion Air Source Control Drawing	EC006125-001	1 ea.

VII. ELECTRICAL LOAD

The incorporation of this kit does not affect the electrical load on the aircraft. A new electrical load report is not required for the aircraft.

VIII. EQUIPMENT REQUIREMENTS

A. CA Document Package
B. Piper Maintenance Manual and Illustrated Parts Catalog
C. Piper 32 Series R134a Conversion Kit P/N 98320503-XXX
D. R12 Recovery/Recycle Equipment
E. R134a Manifold/Charging Unit/Recovery/Recycling Equipment
F. Vacuum Pump rated to -1 atm with tubing and fitting for hook-up
G. Flush Rig (item 10, Chart 1, Appendix A or similar equipment)
H. Valve core removal tool
I. Aircraft service port connections
J. Dry nitrogen supply
K. Temperature Meter with at least two thermocouples

IX. GENERAL NOTES

The vapor cycle system in the Piper 32 Series aircraft should be serviced by a qualified air conditioning technician to modify and charge the vapor cycle system.

WARNING: TO AVOID INJURY TO MAINTENANCE PERSONNEL OR DAMAGE TO EQUIPMENT, MAKE CERTAIN ADEQUATE PRECAUTIONS ARE TAKEN WHILE PERFORMING ANY WORK IF ELECTRICAL POWER IS APPLIED.

WARNING: DUE TO THE AIR QUALITY CONTROL REGULATIONS ENACTED IN THE UNITED STATES AND OTHER COUNTRIES, OPERATORS ARE NOT PERMITTED TO VENT REFRIGERANTS R12, AND R134a. WHEN PERFORMING MAINTENANCE ON THE VAPOR CYCLE SYSTEM WHERE REFRIGERANTS CAN ESCAPE FROM THE SYSTEM, EVACUATE THE SYSTEM WITH A RECOVERY OR RECYCLE SERVICING UNIT.

WARNING: DO NOT SMOKE DURING RECHARGING, FOR REFRIGERANT CONVERTS TO A HIGHLY TOXIC GAS WHEN EXPOSED TO AN OPEN FLAME. A BLAST OF REFRIGERANT CAN ALSO CAUSE BLINDNESS, SO WEAR A FACE SHIELD WHEN HANDLING REFRIGERANT.

CAUTION: ELECTRICALLY GROUND THE AIRCRAFT.

X. AIRCRAFT ACCESS

Access to the following areas will be required:
Evaporator Section (Fuselage)
Condenser Section (Fuselage)
Compressor Section (Power Plant)

XI. VAPOR CYCLE SYSTEM PLUMBING REMOVAL AND REINSTALLATION

Procure CA Installation kit P/N 98320503 by dash number and aircraft serial number effectivity.

PRECAUTIONARY MAINTENANCE INSTRUCTIONS

Before attempting any maintenance that requires opening the vapor cycle system plumbing, the technician must be thoroughly familiar with the servicing instructions and certified to operate the recovery/recycle service unit. These instructions should be followed very carefully when performing the tasks that will maintain this system in a proper functioning order.

The main reasons for these measures are for safety and to prevent dirt and moisture from entering into the system. Dirt or contaminants may cause leaky valves or wear in the compressor. Moisture may not only freeze into ice at the expansion valves, but also cause the formation of hydrochloric or hydrofluoric acids in the system. System performance is degraded by contaminants.

All components are shipped sealed and dehydrated. They are to remain sealed until just prior to making connections and should be at room temperature before uncapping. (This prevents condensation of moisture from the air that enters the system.)

If for any reason the caps are removed but the connections are not made, then the tubes and other parts should not remain uncapped for more than 15 minutes. Reseal connections if the uncapped period is to be longer.

The compressor is shipped with twelve (12) fluid ounces of oil. The compressor uses EC006162-001 ESTER Refrigerant Oil (item 7, Chart 1, Appendix A) and is charged with a mixture of R134a Refrigerant (item 6, Chart 1, Appendix A) and dry nitrogen to provide an internal pressure that is slightly above atmospheric pressure.

All precautions should be taken to prevent damage to fittings or connections. Even minute damage to a connection could cause a leak. Any fittings with dirt

or grease on them should be wiped clean with a cloth dampened with TT-I-735 Isopropyl Alcohol (item 8, Chart 1, Appendix A). Do not use chlorinate solvents such as trichlorethylene as a cleaning agent since they are contaminants. If dirt, grease, or moisture enters the system and cannot be removed, the tubing will have to be removed. Use a small amount of EC006161-001 Sealant (item 9, Chart 1, Appendix A) on connections before assembly. Coat O-rings in EC006162-001 ESTER Refrigerant Oil (item 7, Chart 1, Appendix A) before installation. This will help in making a leak-proof connection.

NOTE: The receiver dryer is the last component to be connected. This is necessary to ensure maximum moisture protection of the vapor cycle system.

In addition to the precautionary maintenance instructions just noted, the following items should be observed:

The vapor cycle system is a high pressure system. Before disconnecting a refrigerant line, the system must be discharged with a recovery or recycle servicing unit. Purge the entire system to a minimum of 28 inches Hg vacuum level.

NOTE: The vapor cycle system plumbing connections are mix of SAE(45°) and JIC(37°) flare fittings. On flare seats that are damaged use EC006067 Flare Gaskets on SAE fittings and SECO Seals on JIC fittings. After the initial tightening, retighten after 30 seconds.

WARNING: When connecting aluminum fittings in the vapor cycle system, tighten as follows:

TUBE SIZE	TORQUE (in-lbs)
-4	55 - 65
-6	100 - 125
-8	200 - 250
-10	300 - 375
-12	400 - 500

CAUTION: Insufficient tightening can result in loose connections and excessive tightening can result in deformed connecting parts. Either condition can result in refrigerant leakage.

Use only the recommended R134a Refrigerant (item 6, Chart 1, Appendix A) in this system. Other refrigerants, particularly those containing methyl chloride, will cause rapid deterioration of the aluminum components.

WARNING: Whenever it is necessary to remove and replace the condenser seal panel, it should be replaced and sealed in the original manner to prevent exhaust gases from entering the cabin. After removing and replacing the rear panel, conduct a carbon monoxide test on the ground and in flight with and without the air conditioner operating. Presence of CO shall not exceed one part in 20,000.

A. DEPRESSURIZING THE VAPOR CYCLE SYSTEM

Use a recovery/recycle service unit to depressurize the system. A qualified air conditioning technician is required to operate the servicing equipment. Refrigerant service ports are located near the evaporator assembly.

TECH INSP

1. Gain access to vapor cycle components. Perform baseline System Functional Test per Section XIII.
2. Check that all electrical equipment in the airplane is turned off.
3. Using the R12 recovery/recycle service unit (item 4, Chart 1, Appendix A).
    a. Attach the service hoses to the service ports at the evaporator assembly. Retain the service port caps for use later in this procedure.
    b. Recover the R12 Refrigerant per acceptable recovery/recycle standards and procedures.

B. EVACUATING THE VAPOR CYCLE SYSTEM

A recovery/recycle service unit (item 4, Chart 1, Appendix A) must be equipped with a vacuum pump capable of obtaining an absolute pressure of 30 inches Hg vacuum and a pressure gage capable of indicating an absolute pressure of 30 inches Hg vacuum. Evacuate the system as follows:

TECH INSP

1. After depressurizing the system, start the vacuum pump, gradually opening the vacuum valve until it is fully open.
2. Open the ballast valve on the vacuum pump slightly until the suction pressure starts.
3. Pull a vacuum in accordance with TABLE I. VACUUM VS. TEMPERATURE. Close gage set valves and vacuum pump valve.

Shut off vacuum pump. If a loss of vacuum exceeds two (2) inches of Hg in five (5) minutes, the system leaks. This is a preliminary check only.

VACUUM VS. TEMPERATURE	
SYSTEM VACUUM	TEMPERATURE F°
27.99	100
28.89	80
29.40	60
29.71	40
29.82	20
29.88	0

TABLE I.

NOTE: In the evacuation procedure, the 30 inches of Hg vacuum is the approximate value for sea level condition. For each 1000-foot increase in field elevation, where system evacuation is performed, the value will decrease one inch of mercury.

C. CLEANING THE VAPOR CYCLE SYSTEM

The system is to be cleaned by a flush rig method. The flush rig method is designed to provide a quick, easy and thorough means of cleaning the aircraft vapor cycle system. By flushing the evaporator coils, condenser coils and lines two objectives are accomplished: 1.) the internal system is cleaned and is free of "contaminants and other foreign material, 2.) all "oil" is removed from the system and the compressor is filled to the proper level, without guessing how much oil is left in the system.

Remove the following pieces of equipment:

WARNING: Make sure that the circuit breaker is pulled for the vapor cycle system.

1. Compressor Removal

TECH INSP

   a. Remove the upper/lower engine cowling and right front baffles to gain access to the air conditioner compressor.
   b. Disconnect electrical leads to the magnetic clutch.

WARNING: Loosen the compressor suction and discharge lines just enough to allow all pressure to bleed off slowly. After pressure has bled off, disconnect the lines from the compressor.

c. Disconnect refrigerant hoses at compressor service fittings.
d. Loosen the bolt securing the compressor idler pulley to release the belt tension and remove belt from compressor pulley. Do not force belt over the pulleys.
e. Support the compressor, remove the six (6) mounting bolts securing the compressor to the engine brackets. Retain hardware for reinstallation.
f. On workbench, remove the compressor pulley and magnetic clutch for reinstallation on new compressor. Reference Piper 28 Series Service Manual.

2. Receiver Dryer Removal

TECH INSP

a. The receiver dryer is located on the inboard side of the evaporator assembly housing.
b. Disconnect the refrigerant lines at the receiver dryer.
c. Remove the clamp attaching the receiver dryer to the evaporator housing. Retain clamps for reinstallation.
d. Install EC006008-001 Flush Connection to the open lines (reference Figure 1. Schematic Appendix B).

3. Expansion Valve Removal

TECH INSP

a. Remove the necessary panels.
b. Remove the capillary coil from the outlet line.
c. Uncouple all related tube fittings. CAUTION fittings may have been installed with Loctite Refrigerant Sealant.
d. Use EC006009-001 Flush Connection to make a straight connection between the expansion valve tubing and the evaporator (reference Figure 1. Schematic Appendix B).

4. Line connections

TECH INSP

a. Install EC006017-001 Flush Connection in open end of compressor suction hose (#10 size) connection (reference Figure 1. Schematic Appendix B).
b. Install EC006018-001 Flush Connection in open end of compressor discharge hose (#8 hose) connection (reference Figure 1. Schematic Appendix B).
c. Remove Schrader valves from the high and low pressure services near the evaporator. Recap the service ports.

d. Check that the connections are tight and that the vapor cycle system lines are now connected in a closed loop.

5. Vapor Cycle System Line Flushing

TECH INSP

a. Check that all electrical equipment in the airplane is turned off. Confirm condenser is in the retracted position.

b. Confirm that steps have been taken to remove the system compressor, receiver dryer, expansion valve. Confirm line connections have been made per steps 2(d), 3(d), and 4(a,b,c). Based on the complexity of the plumbing and the capacity of the system, there are multiple flushing steps that must be followed in order.

c. Record amount of fluid in the holding tank. Connect the flushing rig outlet line to the discharge hose connection position [1] (reference Figure 1. Schematic Appendix B). Connect the flushing rig return line to the suction hose connection position [2] (reference Figure 1. Schematic Appendix B). From the flush rig holding tanks pump the cleaning solution (item 11, Chart 1, Appendix A) through a filter to clean the solution prior to entering the aircraft system.

d. Circulate cleaning solution through the system to be cleaned, for a period of 20 minutes after the cleaning solution has filled the system and returned to the flushing unit. If flushing rig requires more cleaning solution, measure and record amount of solution added to the holding tank. Verify that solution is circulating by observing solution in clear tubing at the return line.

e. Turn pump off and reverse hose connections. The "in" becomes the "out" and "out" becomes the "in". Continue the pumping action to run cleaning solution through the system for another 20 minutes in the opposite direction. Again observe fluid movement in system.

f. After the unit has run for 20 minutes in both directions, the pump switch is turned off, the supply valve is closed. The above-mentioned steps (d-e) should be repeated as the flush rig air valve is opened to filtered shop air. Open shop air supply valve slowly monitoring the pressure up to 100 psig. Run in this direction until return line fluids cease a constant flow. The air will force any solution in the system back into the holding tank, and at the same time dry the tubing. Drain holding tank as required, accurately

measuring solution recovered from the system. The air should run as long as required to clear the system of solution. It is critical to the efficiency of the cooling system to have the lines completely cleared of the cleaning solution.

g. Repeat steps (c - e) with TT-I-735 Isopropyl Alcohol (item 8, Chart 1, Appendix A) to complete the flushing procedure.

h. Make visual inspection that all fluid has been removed from lines.

It is critical to the efficiency of the cooling system to have the lines completely cleared of the cleaning solution. Visually inspect that fluids have been removed from the system. If any residual fluid is evident, use shop air to blow the component dry at the inlet and outlet connections.

CAUTION: Be prepared for some fluid to be blown out of the open connections. Component removal may be required as a last option.

6. Dry Nitrogen Purge: The following steps sequence the nitrogen flow procedure to dry the closed loop system:

CAUTION: Be prepared for some fluid to be blown out of the open ambient connection. The exiting gases and fluid can be directed using tubing clamped to the open connection.

TECH INSP

a. Connect a regulated nitrogen supply to the discharge hose connection position [1] and open the suction hose connection position [2] to ambient (reference Figure 1. Schematic Appendix B). Open the nitrogen valve slowly monitoring the pressure up to 250 psig MAX. Monitor connections at the evaporator module. Run in this direction until exiting gas is clear of fluids. Close the supply valve. Reverse the hose connection and purge in the opposite direction.

b. Ensure that condenser and evaporator fins are straight, clear of debris and fluids. Inspect and repair damaged fins. If condenser removal is required, follow procedures in Maintenance Manual.

c. Clean the compressor, evaporator and condenser compartments (i.e., tubing, floorboards) and exposed areas (i.e., tubing, bulkhead) of residual oils and FOD.

NOTE: Any fittings with dirt or grease on them should be wiped clean with a cloth dampened with TT-I-735 Isopropyl Alcohol (item 8, Chart 1, Appendix A). Do not use chlorinate solvents such as trichlorethylene as a cleaning agent since they are contaminants.

d. Remove flush connections used in the cleaning procedure at the hoses, receiver dryer, and expansion valve.

D. COMPRESSOR INSTALLATION

CAUTION: New compressors may be shipped from the factory fully pressurized. Prior to removing the shipping caps, observe precautions to avoid getting sprayed with oil from the compressor.

NOTE: Special care shall be taken to ensure that the system is not overcharged with oil, since an overcharge of oil in the system will decrease system performance.

NOTE: All openings in compressor shall be capped off to assure that oil in the compressor does not drain out during installation.

NOTE: If the installer chooses to use an existing compressor, drain all oil in accordance with the compressor service manual. Fill compressor with ten (10) fluid ounces of EC006162-001 ESTER Refrigerant Oil (item 7, Chart 1, Appendix A) in accordance with compressor service manual.

TECH INSP

1. Prior to compressor installation, attach the previously removed pulley and magnetic clutch to MA006016-001 Compressor. Reference Piper 28 Series Service Manual.
2. Install EC006095-001 Discharge Port Adapter, and EC006096-001 Suction Port Adapter on compressor service ports, reference installation drawing 98320503 (Appendix B). Install EC006063-001 (2) Flange Washer and EC006060-001 (2) Flange Gasket between the compressor and adapter flange. Lubricate gasket with EC006162-001 ESTER Refrigerant Oil (item 7, Chart 1, Appendix A) before installation. Tighten the adapter flange bolts snug.
3. Place the compressor on the mounting brackets. Install the six bolts and progressively torque to 13-17 ft-lbs. Safety all bolts with .032 safety wire. Reference IPC for installation hardware.

4. Place the compressor drive belt over clutch pulley. Ensure proper belt and pulley alignments per Service Manual. Replace belts if worn with EC006125-001 Compressor Belt.
5. Install the electrical leads to the magnetic clutch.

CAUTION: Do not force the belt into the pulley sheave. If necessary, remove the idler assembly.

E. HOSE ASSEMBLY INSTALLATION

TECH INSP

1. Remove 99592 series hose assemblies from the compressor compartment. Discard hoses.
2. Reinstall hose assemblies as follows:
   a. Install 98280649-001 Hose Assembly between the compressor discharge adapter and mid-fuselage hose along previous hose routing location. Before connecting to the compressor adapter, add two (2) fluid ounces of EC006162-001 ESTER Refrigerant Oil (item 7, Chart 1, Appendix A) to the hose opening. [This amount of oil is the system side.]

NOTE: Any fittings with dirt or grease on them should be wiped clean with a cloth dampened with TT-I-735 Isopropyl Alcohol (item 8, Chart 1, Appendix A). Do not use chlorinate solvents such as trichlorethylene as a cleaning agent since they are contaminants. <u>If dirt, grease, or moisture enter the system and cannot be removed, the tubing will have to be removed.</u> Use a small amount of EC006161-001 Sealant (item 9, Chart 1, Appendix A) on connections before assembly. This will help in making a leak-proof connection.

   b. Install 98280650-001 Hose Assembly between the compressor suction adapter and mid-fuselage hose along previous hose routing location. See note above.
   c. Tighten suction and discharge adapter flange bolts to 17-25 ft-lbs.

F. COMPONENT REINSTALLATION

TECH INSP

1. Rear Cabin Panel Service Port Installation
   a. Install EC006049-001 HP Service Port Assembly to the discharge port, reference installation drawing 98320503 (Appendix B).

b. Install EC006048-001 LP Service Port Assembly to the suction port, reference installation drawing 98320503 (Appendix B).

2. At compressor, install two (2) EC006057-001 Disabler Caps on Suction and Discharge Adapter.

G. EXPANSION VALVE INSTALLATION

TECH INSP

1. Position EC006053-001 Expansion Valve in the evaporator plenum and attach the inlet, and outlet. Use a small amount of EC006161-001 Sealant (item 9, Chart 1, Appendix A) on connections before assembly. Use EC006067 Flare Gasket or SECO Seal as required on existing lines.
2. Assure that no exterior corrosion has formed on the evaporator outlet tube at the point of contact with the expansion valve capillary coil. Locate thermal bulb by mounting at 3-4 o'clock position on horizontal suction line. If bulb is placed on vertical suction line, mount so the capillary comes from the top.
3. Lubricate the capillary coil and the evaporator outlet tube in the area of contact with the thermal bulb clamp with EC006157-001 Silicone Lubricant (item 1, Chart 1, Appendix A).
4. Clamp the expansion valve capillary coil to the evaporator outlet line. Use EC006160-001 Bulb Clamp or supplied hardware.
5. Wrap the capillary coil and clamp with EC006046-001 Insulation Tape (item 2, Chart 1, Appendix A). Seal around the insulation with EC006158-001 Vinyl Film Tape (item 3, Chart 1, Appendix A). Ensure that the area where the capillary coil line exits from the insulation is well sealed by the tape.

H. RECEIVER DRYER INSTALLATION

TECH INSP

1. Install EC006052-001 Receiver Dryer to the aircraft bracket so the inlet line can be connected to the inlet port (IN) and the outlet line can be connected to the outlet port. Reference directional flow arrow. Tighten the clamps securing it to the mounting bracket.
2. Connect the inlet and outlet lines to the receiver dryer. Use a small amount of EC006161-001 Sealant (item 9, Chart 1, Appendix A) on all male flare connections before assembly. Use EC006067 Flare Gasket as required on existing lines. Torque the fittings in accordance with TABLE I. (see Section XI).

I. LEAK CHECK

TECH INSP

1. Hook up the charging manifold and hose assembly to the high pressure and low pressure services valves on rear panel. This equipment stays in the airplane during complete functional check through final charging.
2. Connect the vacuum pump to charging manifold.
3. Open valve on vacuum pump and both valves on manifold.
4. Turn on vacuum pump to begin evacuation of the system.
5. The system should be evacuated for a minimum of 30 minutes after system has reached gage pressure of 28 inches Hg vacuum or less. This pump-down procedure should require no more than four (4) hours if there are no leaks in the system.

NOTE: In the evacuation procedure, 30 inches of Hg vacuum is the approximate value for sea level condition. For each 1000-foot increase in field elevation, where system evacuation is performed, the value will decrease one inch of mercury.

6. Close (TURN CW) both hand valves. Turn vacuum pump off. Observe system for pressure increase. If system holds vacuum for 10 minutes – this shows a tight system in vacuum.

NOTE: Prior to connecting refrigerant or nitrogen supply hose to charging manifold, purge hose prior to tightening hose fitting.

7. As an option, if installer has access to an electronic leak detector. Open valve to R134a source and add one pound of refrigerant. Close valve. This step should be considered if system has history of hard to find leaks.
8. Remove vacuum pump hose from charging manifold and connect dry nitrogen to charging manifold.

NOTE: Pressurize through the manifold high side. Close off and isolate low pressure side to protect LP gage. Pressurize incrementally – allowing system to equalize across high and low sides of system.

CAUTION: **<u>EXTREME CAUTION</u> is to be used in either the bench test or aircraft pressure check. If possible secure evaporator and hoses to the bench. Gradual increases in pressures should be used while observing the seal leakage using soapy water bubble check.**

9. Pressurize system with dry nitrogen to 250psi ±10psi and check leaks by closing charging manifold valves to isolate system and check for pressure drop. A leak would consist of 5 psi pressure drop in 10 minutes.
10. The system may also be checked by maintaining 250psi ±10psi and using leak detector and/or soapy mixture. Check all joints.
11. For persistent hard to pinpoint leaks, one ounce of dye type leak identifier compatible with R134a may be added to the system and used for visual inspection. This step can only be done with system fully charged and operating.

CAUTION: Dye stains upholstery and paint. Areas of possible leaks should be protected with rags.

J. FINAL LEAK CHECK

TECH INSP

1. With pressure reading at 250psi ±10psi, close valves on charging manifold and hose and disconnect nitrogen supply. Keep charging manifold and hose connected to monitor pressure bleed down.
2. Record pressure reading from gage and ambient temperature (assuming aircraft has been in the hangar a minimum of two hours to allow temperature stabilization).
3. Allow system pressure to stabilize a minimum of 24 hours.
4. Record system pressure and temperature after 24 hours. The measurement is valid only after two hours minimum temperature stabilization in the hangar.
5. Using the Pressure and Temperature Chart (Appendix C), depending on final temperature being above and below initial temperature, add or subtract the ΔP to the initial pressure reading.
6. Compare the adjusted initial pressure with the final pressure. If the system loss is greater than 10psi, there is a system leak which must be corrected. When leak has been fixed, rerun pressure check.
7. Upon satisfactory result depressurize system into an appropriate recovery system. Evacuate system to 28 inches of Hg vacuum or less.

TECH INSP

K. Charge the system as described in CHARGING THE VAPOR CYCLE SYSTEM.

XII. CHARGING THE VAPOR CYCLE SYSTEM

The vapor cycle system in the Piper 32 Series aircraft system should be serviced by a qualified air conditioning technician. The following procedure will enable the technician to charge the vapor cycle system. Figure 2, Air Conditioning Schematic (Appendix B), shows the vapor cycle system and typical service unit schematic.

NOTE: The vapor cycle system contains a total charge of 1.9 pounds (31 ounces) of R134a Refrigerant. CAUTION is to be used not to overfill the system. This will cause an overall lowering in system performance.

TECH INSP

A. Check that all electrical equipment in the airplane is turned off. Confirm VCS circuit breaker position.

WARNING: Do not smoke during recharging, for refrigerant converts to a highly toxic gas when exposed to an open flame. A blast of refrigerant can also cause blindness, so wear a face shield when handing refrigerant.

CAUTION: The compressor used on this Piper 32 aircraft modification is designed for use with R134a Refrigerant only. Use of any other refrigerant may permanently damage these compressors.

TECH INSP

B. Confirm that service unit is connected to the service port connections located near the evaporator assembly. Confirm system is properly evacuated. Confirm that service/charging unit is properly set-up and that the required R134a Refrigerant (item 6, Chart 1, Appendix A) charge is fully loaded (31 ounces).

NOTE: If the vapor cycle system requires a partial charge or is being recharged after replacement of a unit such as the compressor or receiver dryer, or if the system has been completely discharged of refrigerant, evacuate the entire system to 28 inches Hg vacuum or less, with a vacuum pump to assure efficient, trouble-free operation.

TECH INSP

C. Confirm that the low pressure manifold control valve is closed. Fully open refrigerant control valve and allow the liquid refrigerant contained in the charging cylinder to enter the HIGH pressure side of aircraft system. Add the full charge of refrigerant to the HIGH pressure side. Close HIGH side service valve on manifold.

TECH INSP

D. Confirm wheel chalks and set aircraft brake. Run the cooling system (fifteen (15) minutes engine @ 1000 RPM) with the Air Conditioning Selector switch in the ON position and the Blower switch in the HIGH position. Observe the refrigerant level through the sight glass located in the top of the receiver dryer. If required, add the remainder of the initial refrigerant charge to the LOW pressure side, in vapor form ONLY, and close valves.

TECH INSP

E. The system is now charged. Run system 2 minutes at 2000 RPM. Pull back to 1000 RPM and the gage pressures should match Table II. The maximum cooling effect as specified in the System Functional Test is reached by adding small amounts of the refrigerant to the system until system performance matches current atmospheric conditions. This will vary slightly from aircraft to aircraft. The system maybe fully charged even though the refrigerant in sight glass appears milky and/or has bubbles. CAUTION is to be exercised not to overcharge the system. It is important that the end charge amount be recorded in step (H) below. If the system is exposed to moisture, the receiver dryer should be replaced.

TECH INSP

F. Run system for a minimum of 30 minutes with a minimum of two starts and stops, to allow system to stabilize. Observe the high pressure gage to assure pressure does not go above 350 psi. Confirm that condenser fan is operating. If not, shut down system immediately and troubleshoot.

TECH INSP

G. Perform System Functional Check Section XIII.

TECH INSP

H. Fill out information on the EC006159-001 R134a Retrofit Label and install at a clearly visible location near the compressor and service ports, (reference Appendix C for label identification).

XIII. SYSTEM FUNCTIONAL TEST

A. Functional Check: The vapor cycle system must be charged with R134a Refrigerant per Section XII of this Engineering Order before performing this procedure. The operational check should be performed in 60°F or higher ambient temperature.

TECH INSP

1. Apply power to aircraft. Push in VCS compressor circuit breaker. Compressor should begin operating. Turn Air Conditioning selector switch to the ON position. Toggle

the Blower Switch to the HIGH position. Set Temperature selector to LOW.

2. The ambient air temperature must exceed 60° F to run this test without adding heat to the evaporator air inlet. Record ambient air temperature. Close cabin door.
3. Allow system to run for 15 minutes. Confirm that the suction and discharge pressures match the Table II. within several PSI.
4. Record cabin air outlet temperatures. Confirm that the vent outlets are 25±5°F lower than outside or ambient temperature.
5. Turn off vapor cycle system. Turn off engine. Close all valves and allow system to stabilize for 5 minutes. Remove low pressure gage hose from the low pressure service port. Use a rag around the service valve to catch the refrigerant spray with oil trapped in the hose. Remove the high pressure hose as described above. Some oil will be in the refrigerant trapped in the hose, so use a rag while disconnecting. Install service port caps. Replace all access panels. Close cowlings.

TEMPERATURE (F°)		COMPRESSOR PRESSURE (PSI)	
AMBIENT (OAT)	**PLENUM (MAX)**	**SUCTION**	**DISCHARGE**
60	**45**	**15-20**	**120-170**
70	**49**	**15-22**	**140-200**
80	**54**	**15-25**	**165-230**
90	**59**	**18-30**	**185-260**
100	**64**	**20-35**	**206-290**
110	**69**	**22-40**	**230-320**

TABLE II.

6. Complete installation as outlined in step XII (H).
7. Advanced charging diagnostics and troubleshooting can be found in Document SA000006.

WARNING: Whenever it is necessary to remove and replace the condenser seal panel, it should be replaced and sealed in the original manner to prevent exhaust gases from entering the cabin. After removing and replacing the rear panel, conduct a carbon monoxide test on the ground and in flight with and without the air conditioner operating. Presence of CO shall not exceed one part in 20,000.

XIV. COOLING SYSTEM - MAINTENANCE

SERVICING

Follow the prescribed maintenance schedule and troubleshooting procedures outlined in Piper 32 Maintenance Manual (except as noted).

SYSTEM LEAK DETECTION

A persistent reduction of system cooling ability may indicate a partial loss of refrigerant. The sight glass should be checked during system operation at maximum available ambient and cabin temperatures. The sight glass is located on receiver dryer. Streams of bubbles or foam seen in the glass may indicate the refrigerant quantity is low. R134a Refrigerant does not follow the same sight glass rules as the older R12 principles.

If a loss of refrigerant is suspected, the system plumbing should be inspected to determine the source of the leak. Large leaks can be located by the appearance of oily spots where oil has been carried out by the escaping refrigerant. Smaller leaks, which are much more difficult to locate, can be detected by a detergent test or by an electronic detector. The system must contain a partial charge in order to detect leaks. The detergent test is accomplished by applying soap suds to an area suspected of leaking. Bubbles may form if leaks are present. An electronic detector includes a probe that is moved along the plumbing to detect escaping refrigerant. The probe should be held below the line because R134a Refrigerant is heavier than air. The probe should be capable of detecting leaks equal to 1/2 ounce per year and will emit a flashing light or a high-pitched sound when escaping refrigerant is detected.

If a connection leak is found, tighten the connection to the standard torque value for that fitting. If a connection does not seal by the normal tightening procedure, the fittings should be repaired using soft seals.

NOTE: If a leak occurs at a flare fitting containing a soft seal, replacement of the gasket seal and/or fitting is recommended. Minor leakage is permissible at the compressor shaft seal. Use EC006161-001 Sealant (item 9, Chart 1, Appendix A) and EC006067 Flare Gaskets or SECO Seals on flared tube and hose connections, as required, to help prevent leakage.

NOTE: It is permissible to add R134a compatible red trace dye to the low pressure service port to detect leaks. A red film will appear in the area where leaks are present.

CAUTION: The vapor cycle system MUST be operated for a 2 to 3 minute period at approximately 30 to 45 day intervals in ambient temperatures of 50°F or above to keep the seals from drying out and to prevent the formation of corrosive acids.

COMPRESSOR BELT TENSION ADJUSTMENT

If a new belt is installed with this modification, the belt should stretch to a normal operating point after 36 to 48 hours of operation. The belt should be checked at this time and adjusted for alignment/tension.

Follow the prescribed maintenance schedule in the Maintenance Manual or Shop Manual.

CHECKING THE REFRIGERANT LEVEL

Check the refrigerant level as required using the following sequence:

1. Start the vapor cycle system.
2. Allow the system to operate for approximately ten minutes.
3. Observe the sight glass on receiver dryer. Evaluate system performance per Section XIII and Advanced Diagnostic and Troubleshooting SA000006.
4. Charge the vapor cycle system with refrigerant per Section XI. CHARGING THE VAPOR CYCLE SYSTEM as required.

NEW COMPRESSOR OIL CHARGE

The compressor is shipped with twelve (12) fluid ounces of oil. The compressor uses EC006162-001 ESTER Refrigerant Oil (item 7, Chart 1, Appendix A) and may be charged with a mixture of R134a Refrigerant and dry nitrogen to provide an internal pressure that is slightly above atmospheric pressure.

CHECKING COMPRESSOR OIL LEVEL [YORK TYPE COMPRESSOR]

The compressor oil level should be checked by a qualified air conditioning technician. The oil shall be checked and/or charged only when adding

refrigerant to the system and after the vapor cycle system has been evacuated.

The compressors are factory charged with twelve (12) fluid ounces of EC006162-001 ESTER Refrigerant Oil (item 7, Chart 1, Appendix A). Only this or equivalent oils should be used when adding oil to the system. To check the compressor oil level, use the following procedure:

a. Verify system is evacuated. Remove the oil plug and O-ring.
b. Before inserting the dipstick, the crankshaft Woodruff key should be located in the up position. The front face of the compressor clutch is marked with a stamped "K" indicating the key position. The oil level should be measured from the lowest point in the crankcase.
c. With the compressor in the installed position use Table III. to determine the amount of oil in the crankcase.
d. The compressor should never be operated with less than 6 fluid ounces of oil. When oil is added the level should not go above 12 fluid ounces. For best results the oil level should be kept at 8 to 12 fluid ounces. An excessive amount of oil is detrimental to the proper functioning of the entire system. Use only the recommended EC006162-001 ESTER Refrigerant Oil (item 7, Chart 1, Appendix A).

Oil Charge (Ounces)	**6**	**8**	**10**	**12**	**14**	**16**
Dipstick Reading (Inches)	**13/16″**	**1″**	**1-3/16″**	**1-5/8″**	**1-13/16″**	**1-15/16″**

TABLE III.

e. Reinstall the oil fill plug. Ensure that the sealing O-ring is not twisted when slipping it over the oil fill plug threads. Insert and tighten the plug. If it leaks, do not attempt to stop the leak by overtightening the plug. The leak may be caused by dirt under the O-ring or on the seat, a fractured O-ring or a damaged seat on the oil fill plug or oil filling opening. To stop the leak correct the mechanical damages and insert a new O-ring.
f. Charge system and return aircraft to service.

Measuring the oil accurately in these in-service vapor cycle systems is difficult. Experienced personnel have to use good judgment and care to determine if additional oil is to be added.

If a refrigerant leak or oil leak has occurred or if it is suspected that the system is low on oil, a small amount of oil may be added to the system.

NOTE: A few drops of oil on refrigerant plumbing joints may look like a major leak when the actual oil loss is negligible. If a refrigerant leak appears to carry a large amount of oil with the refrigerant, a small quantity of EC006162-001 ESTER Refrigerant Oil (item 7, Chart 1, Appendix A) may be added to the system.

Too much oil in the system may cause a reduction in the cooling capacity of the system. If the oil in the system becomes excessive, the oil may "slug" the compressor, damaging the compressor and compressor drive.

If there is a small refrigerant leak which does not appear to carry oil with it, oil probably should not be added.

If the refrigerant leak is more severe and oil is being carried out with the refrigerant, 1 to 2 fluid ounces may be added to the system once a year.

If the oil loss is severe and the amount cannot be calculated, the leak(s) should be repaired. After repair, the system should be flushed per Section XI. to remove all the oil and contaminants. [Replace Receiver Dryer]

After flushing, drain compressor oil, add twelve (12) fluid ounces of EC006162-001 ESTER Refrigerant Oil (item 7, Chart 1, Appendix A) to compressor reservoir. An additional two (2) fluid ounces of EC006162-001 ESTER Refrigerant Oil (item 7, Chart 1, Appendix A) must be added to the evacuated system.

If the compressor is replaced, new compressors are shipped with twelve (12) fluid ounces of EC006162-001 ESTER Refrigerant Oil (item 7, Chart 1, Appendix A). If the system has been flushed and evacuated, an additional two (2) fluid ounces of EC006162-001 ESTER Refrigerant Oil (item 7, Chart 1, Appendix A) must be added to the system.

Any time a refrigerant carrying component is removed, it is best to accurately measure the oil in that component and replace only that quantity of oil.

NOTE: Any time the oil is drained from a component of the system, a small quantity of oil will remain in that component. Calculate the amount of oil remaining in the component (up to one ounce in

the compressor) and add this amount to the amount of oil drained from the component. When the system is reassembled, this amount of oil should be added back into the system. When draining the oil from the compressor, rotate the compressor to keep from trapping oil in the compressor.

APPENDIX A:
MATERIALS CHART 1

MATERIALS CHART 1

MATERIAL	SPECIFICATION	PRODUCT	VENDOR
1. Silicone Lubricant	Supplied In Kit	EC006157-001	Kit Supplier
2. Insulation Tape	Supplied In Kit	EC006046-001	Kit Supplier
3. Vinyl Film Tape	Supplied In Kit	EC006158-001	Kit Supplier
4. R12 Recovery/Recycle Unit			Local
5. R134a Charging Unit			Local
6. R134a Refrigerant			Local
7. ESTER Refrigerant Oil	Supplied In Kit	EC006162-001	Kit Supplier
8. Isopropyl Alcohol		TT-I-735	Local
9. Sealant	Supplied In Kit	EC006161-001	Kit Supplier
10. Flush Rig			Local
11. Flushing Solution	ESTER Based Flush		Local

APPENDIX B:
FLUSHING/CHARGING SCHEMATIC AND INSTALLATION DRAWING

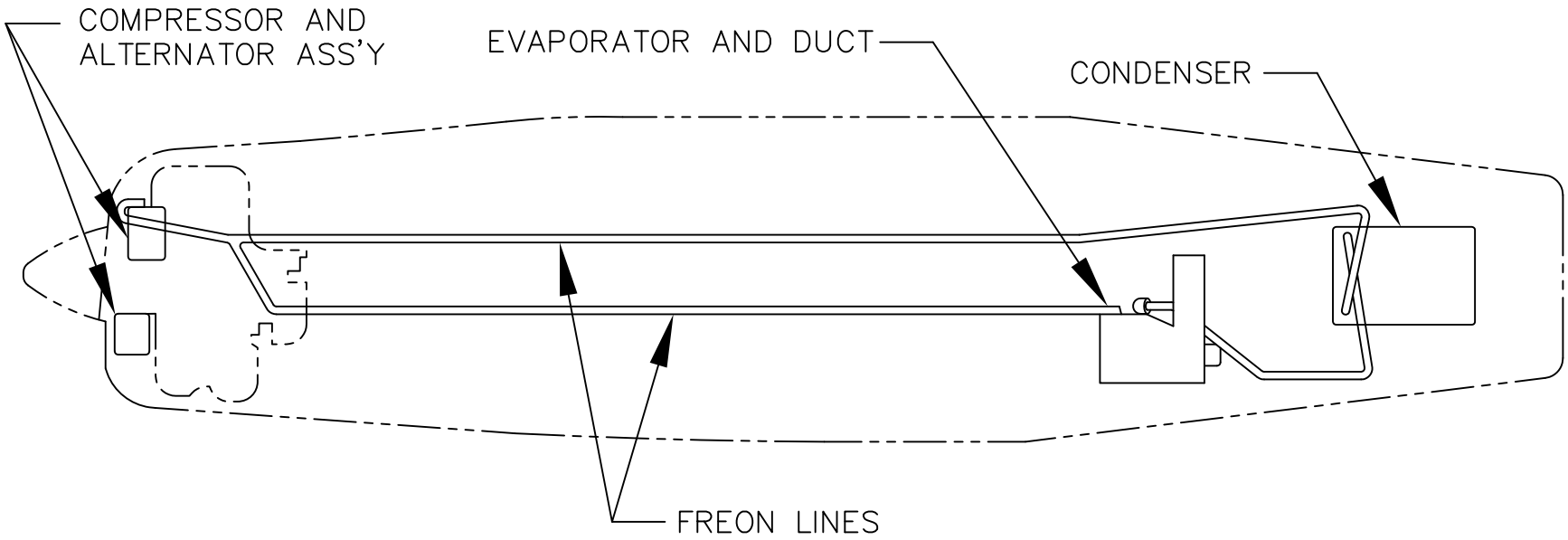


FIGURE 1. PIPER 32 SERIES
COOLING SYSTEM SCHEMATIC

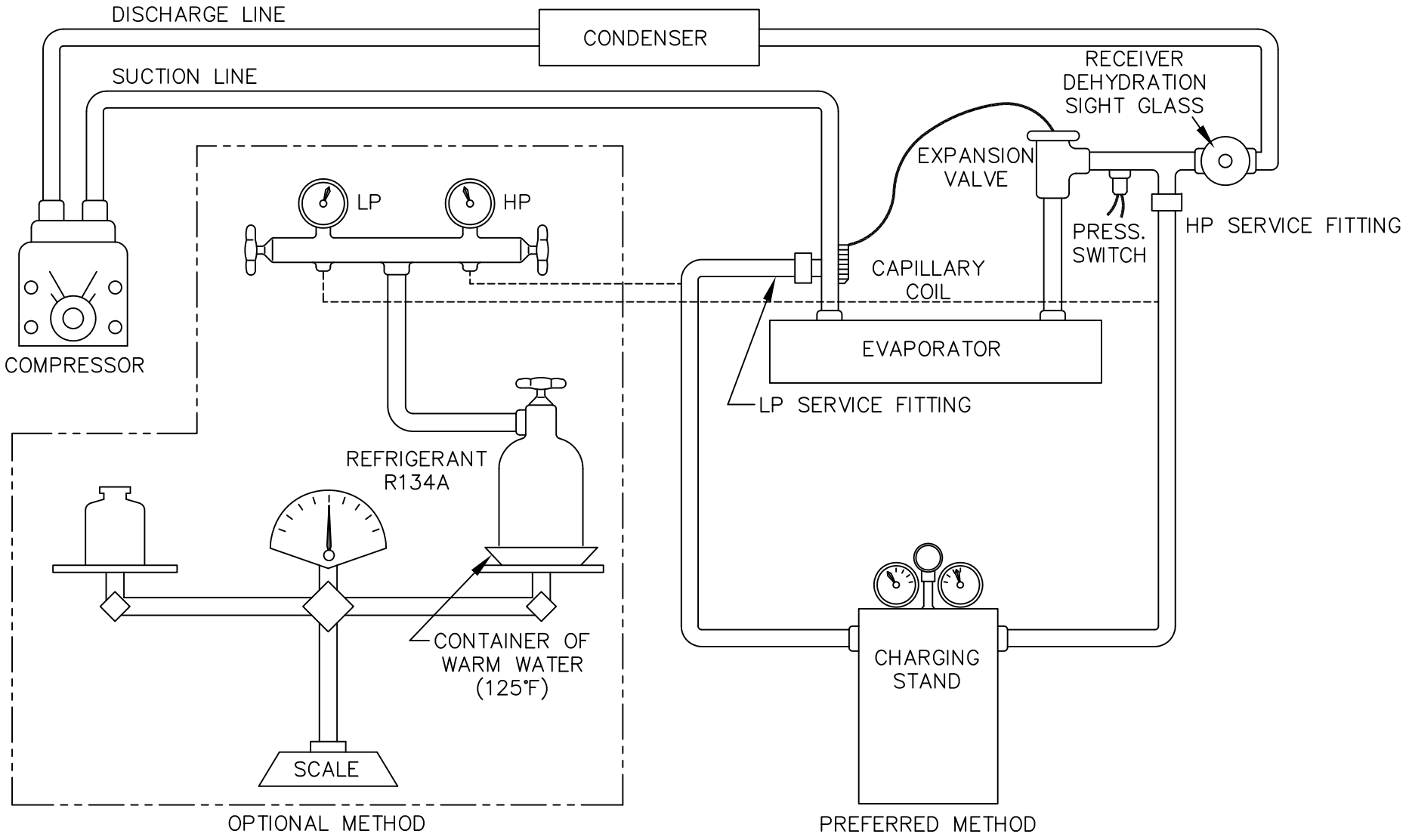
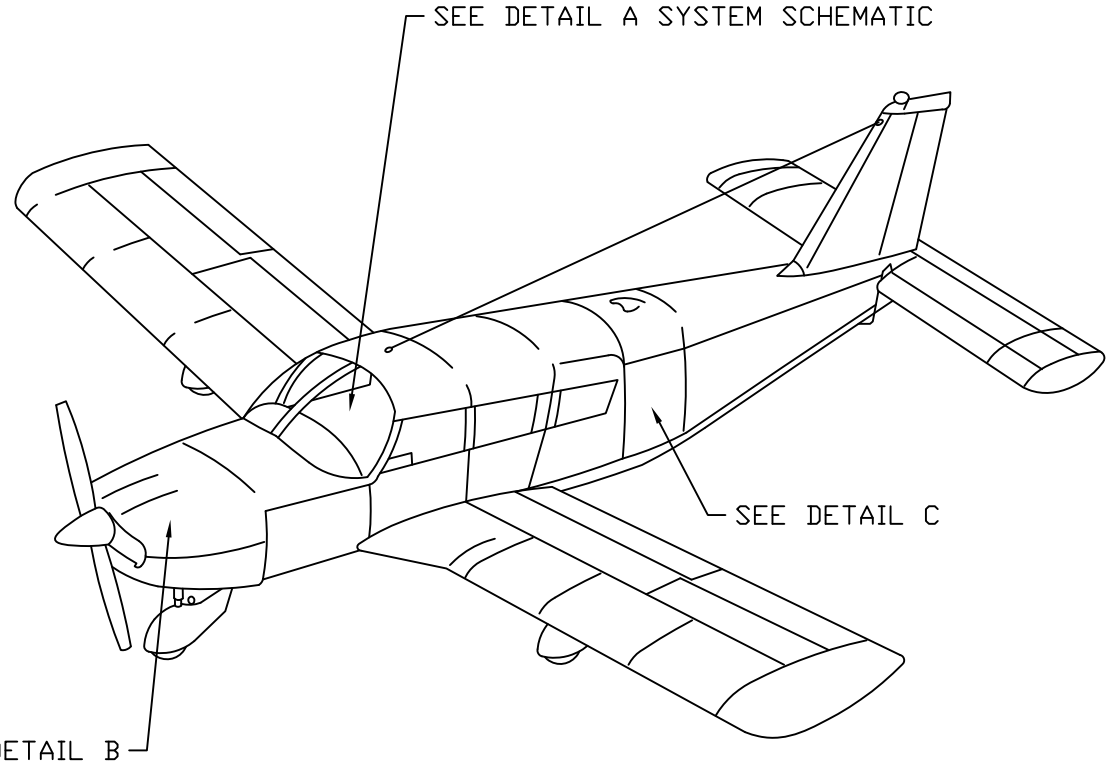


FIGURE 2. PIPER 32 SERIES
BELT DRIVEN SYSTEM
AIR CONDITIONING SCHEMATIC

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
IR	SEE ECN	01-15-98	S. STEINBACH
A	SEE ECN 01369, ADD CLUTCH/BELT	09-19-00	S. STEINBACH
B	SEE ECN 01793, UPDATE DOCUMENT	05-20-14	S. STEINBACH
C	SEE ECN 01882, UPDATE DOCUMENT	08-16-17	S. STEINBACH



PIPER PA-32-301 "SARATOGA"

QTY	SPARE	IDENTIFYING NO.	NOMENCLATURE	CAGE CODE	MATL SPEC AND MATERIAL OR VENDOR NAME AND ADDRESS	CALC WEIGHT	FINISH	ZONE	ITEM NO.
		PARTS LIST	DDD DASH NUMBER SHOWN-EVEN DASH NUMBER OPPOSITE						
2		EC006057-001	DISABLER CAP						
1		EC006177-007	SEAL KIT			(7)			
1		EC006009-001	FLUSH CONNECTION			(5)			
1		EC006008-001	FLUSH CONNECTION			(5)			
1		EC006018-001	FLUSH CONNECTION			(5)			
1		EC006017-001	FLUSH CONNECTION			(5)			
1		EC006162-001	COMPRESSOR ESTER OIL			(5)			
1		EC006161-001	SEALANT			(5)			
1		EC006160-001	BULB CLAMP			(5)			
2		EC006159-001	RETROFIT LABEL			(5)			
24"		EC006158-001	VINYL FILM TAPE			(5)			
24"		EC006046-001	INSULATION TAPE			(5)			
1		EC006157-001	SILICONE LUBRICANT			(5)			
1		EC006096-001	SUCTION PORT ADAPTER						
1		EC006095-001	DISCHARGE PORT ADAPTER						
2		EC006063-001	FLANGE WASHER						
1		EC006048-001	SERVICE PORT ASSY, LP						
1		EC006049-001	SERVICE PORT ASSY, HP						
1		EC006053-001	EXPANSION VALVE						
1		EC006052-001	RECEIVER DRYER						
1		MA006016-001	R134A COMPRESSOR (12)						
2		EC006060-001	FLANGE GASKET						
1		98280650-001	HOSE ASSY						
1		98280649-001	HOSE ASSY						
		-001	CONVERSION KIT (3) (4)						
-001		IDENTIFYING NO.	NOMENCLATURE	CAGE CODE	MATL SPEC AND MATERIAL OR VENDOR NAME AND ADDRESS	CALC WEIGHT	FINISH	ZONE	ITEM NO.

(12) USE COMPRESSOR PULLEY/CLUTCH EC006126-001 AND COMPRESSOR BELT EC006125-001 AS A REPLACEMENT TO EXISTING COMPONENTS.

(11) ORIENT SERVICE PORT ADAPTER AS REQUIRED.

(10) INSTALL HOSE ASSEMBLY USING EXISTING HOSE ROUTING LOCATION. REMOVE R12 HOSES.

(9) AFFIX EC006159-001 RETROFIX LABEL NEAR TO THE SERVICE PORTS IN CLEAR VIEW.

(8) RE-ASSEMBLE USING EXISTING HARDWARE AND FITTINGS.

(7) THE USAGE OF SOFT SEAL GASKETS MAY BE REQUIRED ON FLARED FITTING CONNECTIONS. COPPER GASKETS SHOULD BE USED IN COPPER AND BRASS FITTINGS AND ALUMINUM GASKETS SHOULD BE USED IN ALUMINUM FITTINGS. USE EC006161-001 SEALANT ON ALL FLARED TUBE AND HOSE CONNECTIONS TO HELP PREVENT LEAKAGE.

(6) CAUTION IS TO BE EXERCISED THAT FITTINGS FOR THE HIGH AND LOW SIDE PRESSURES ARE CONNECTED TO THE CORRECT DISCHARGE AND SUCTION SERVICE PORT. APPLY ESTER OIL TO THREADS.

(5) PART OF ENGINEERING ORDER 98320603.

(4) TO BE USED ON PIPER MODEL PA-32-301 SERIAL NUMBER 32-8006001 AND UP.

(3) KIT DASH NUMBERS PRECEDED BY 'WD' ARE SUPPLIED WITHOUT COMPRESSOR.

2. REFERENCE ENGINEERING ORDER 98320603 FOR INSTALLATION PROCEDURE.

1. ALL PARTS, ASSEMBLIES, AND HARDWARE SHALL BE LEGIBLY IDENTIFIED.

GENERAL NOTES:

(UNLESS OTHERWISE SPECIFIED)

THIRD ANGLE PROJECTION

TOP LEVEL	32 SERIES
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
DECIMALS
ANGLES
FINISH 125
MFG AND PROCESS PER
FINISH SYM PER
BPTG AND BUMPER MIL-STD-100

PROJECT/ CONTRACT NO. 9832
DRAFTSMAN A. ZEFFEL 01-15-98
CHECKER A. ZEFFEL 01-15-98
MFG PLAN R. FINCH 01-15-98
STRESS S. STEINBACH 01-15-98
PROCESS S. STEINBACH 01-15-98
PROJ ENG S. STEINBACH 01-15-98
SEE ECN FOR APPROVAL SIGNATURES

CONVERSION AIR
WACO, TEXAS

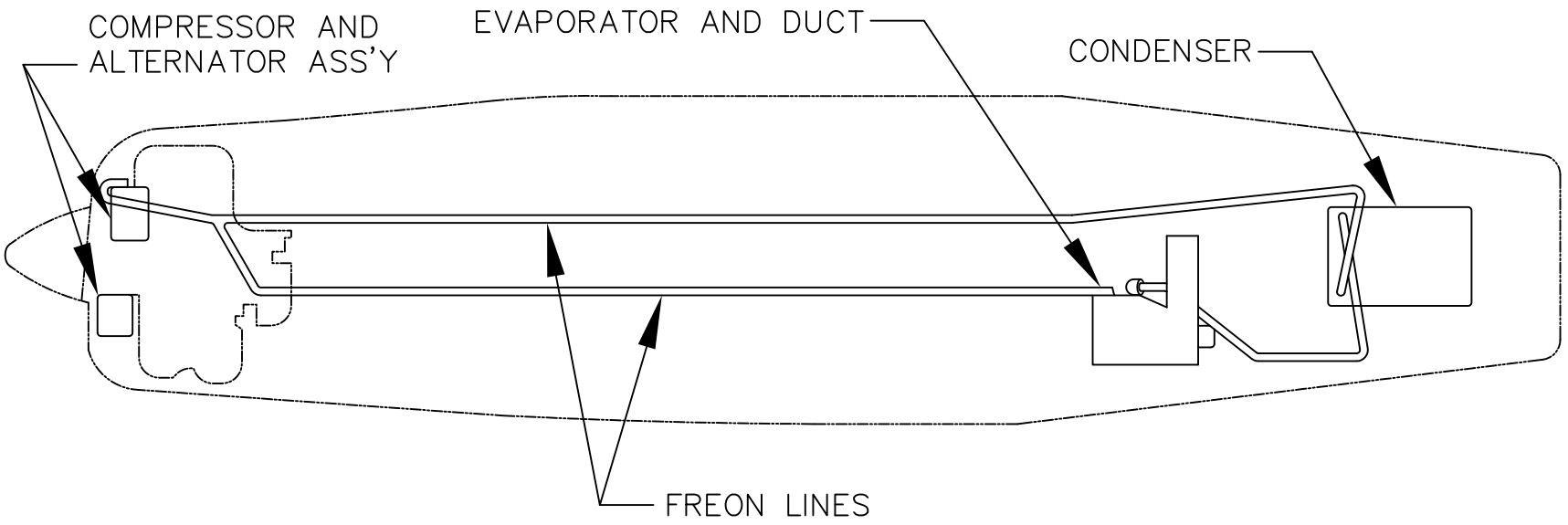
PIPER 32 SERIES
PA-32-301
R134A CONVERSION

SIZE E | CAGE CODE | DWG NO. 98320503 | REV. C
SCALE NONE | SHEET 1 OF 4

FORM 7005E

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
C	SEE SHEET 1		

PIPER PA-32-301 "SARATOGA"



FWD

TBD

DETAIL A

THIRD ANGLE PROJECTION	SIZE E	CAGE CODE	DWG NO. 98320503	REV. C
	SCALE 1/1		SHEET 2	

CONVERSION AIR
WACO, TEXAS

FORM 7002E

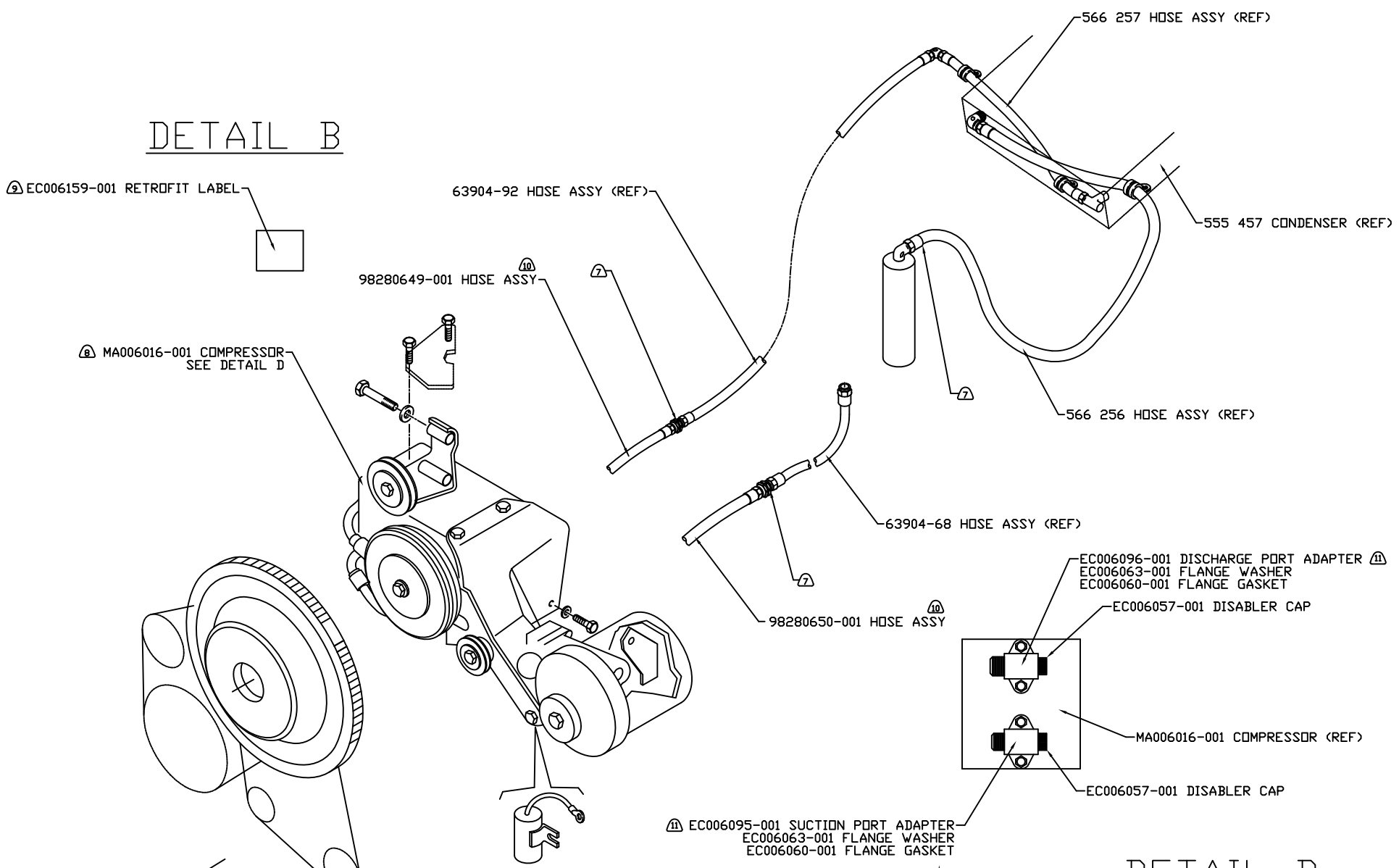
Drawings are controlled by Document Control
check for latest revision thru office vision

98320503 2.DWG

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
C	SEE SHEET 1		

PIPER PA-32-301 "SARATOGA"

DETAIL B



DETAIL D

THIRD ANGLE PROJECTION	SIZE E	CAGE CODE	DWG NO. 98320503	REV. C
	SCALE NONE		SHEET 3	

CONVERSION AIR
WACO, TEXAS

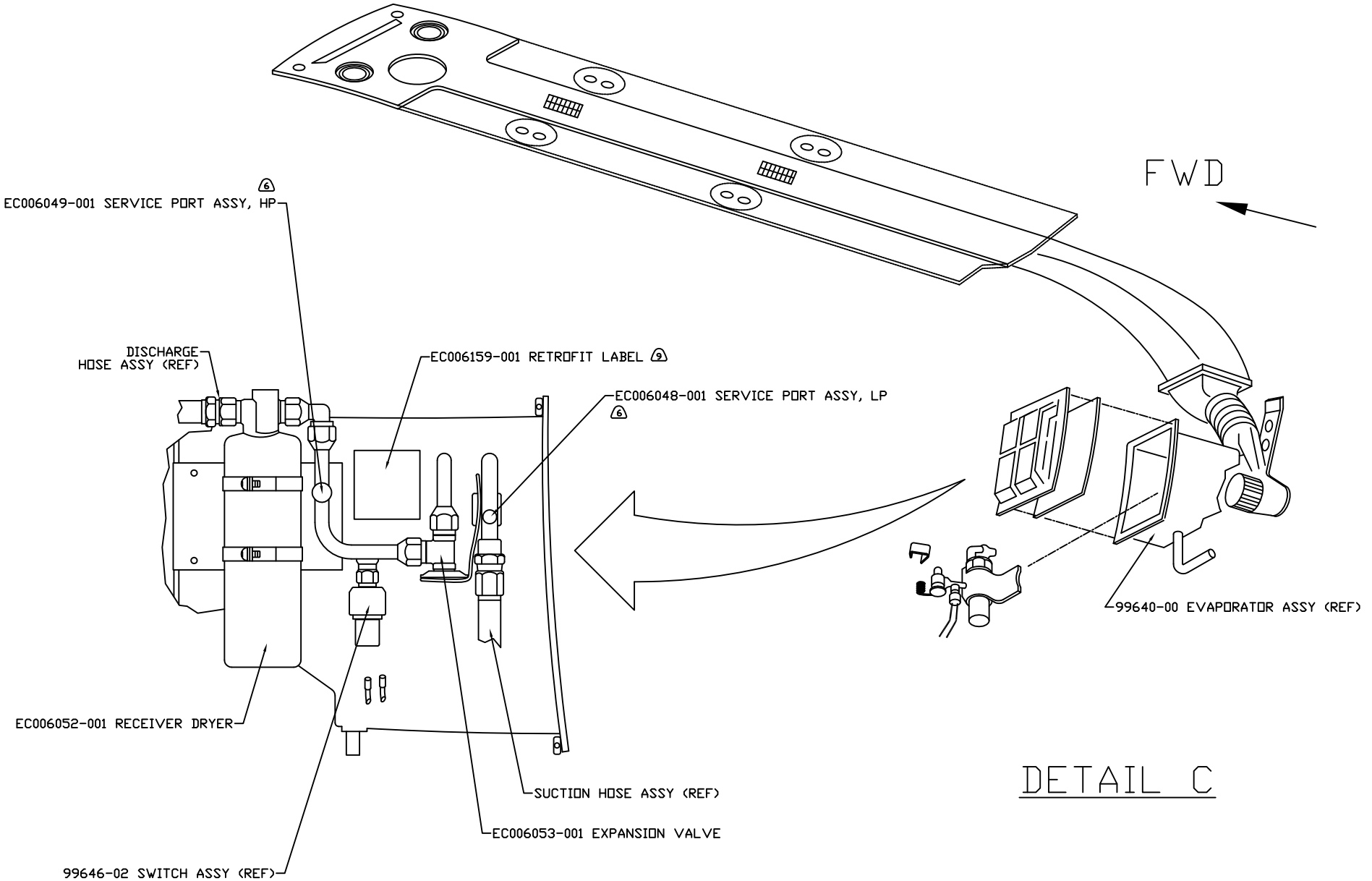
FORM 7002E

Drawings are controlled by Document Control
check for latest revision thru office vision

98320503 C Sht 3

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
C	SEE SHEET 1		

PIPER PA-32-301 "SARATOGA"



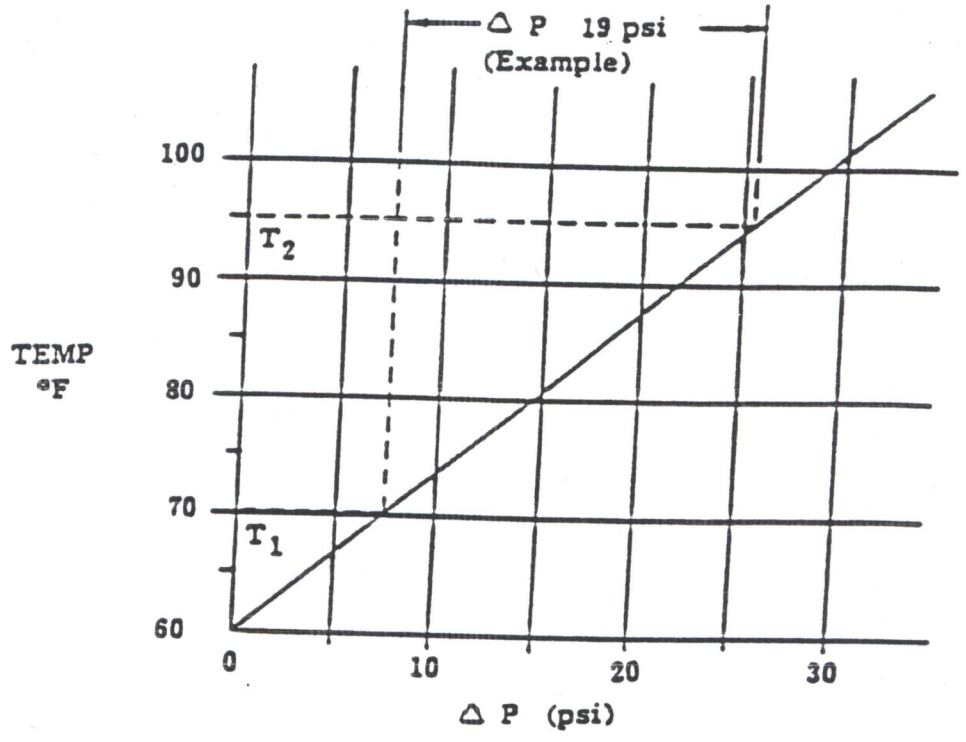
DETAIL C

CONVERSION AIR WACO, TEXAS				
THIRD ANGLE PROJECTION	SIZE E	CAGE CODE	DWG NO. 98320503	REV. C
	SCALE 1/1		SHEET 4	

DWG NO. 98320503 SH 4 REV C

Drawings are controlled by Document Control check for latest revision thru office vision

APPENDIX C:
PRESSURE CHART AND R134A WARNING LABEL DESCRIPTION



Example of Calculation: T_1 = 70°F, P_1 = 380 psi, T_2 = 95°F, P_2 = 385 psi. From chart P = 19.

Temperature and pressure at the beginning of the test is 70°F and 380 psi. Temperature and pressure after 24 hours is 95°F and 385 psi. From the chart, the differential pressure (ΔP) is 19 psi. When this differential pressure is added to the pressure which was recorded at the beginning of the test (380 psi + 19 psi) a new adjusted pressure of 399 psi has been established. This pressure subtracted from the pressure after 24 hours indicated a drop in pressure of 14 psi (385 psi - 399 psi = -14 psi) indicating a leak in the system.

If temperature at beginning of the test is lower than that after 24 hours - add the differential psi to P_1 pressure and subtract from P_2 pressure.

If temperature at beginning of test is higher than that after 24 hours - subtract differential pressure from P_1 pressure and subtract from P_2 pressure.

⚠ CAUTION	NOTICE: RETROFITTED TO R-134a
R-134a REFRIGERANT UNDER HIGH PRESSURE SYSTEM TO BE SERVICED BY QUALIFIED PERSONNEL ONLY. IMPROPER SERVICE METHODS MAY CAUSE PERSONAL INJURY. P/N 59970	RETROFIT PROCEDURE PERFORMED TO SAE J1661 USE ONLY R-134a REFRIGERANT AND SYNTHETIC OIL # OR EQUIVALENT, OR A / C SYSTEM WILL BE DAMAGED DATE RETROFITTER NAME ADDRESS CITY / STATE REFRIGERANT CHARGE / AMOUNT LUBRICANT / TYPE AMOUNT AUXILIARY LABEL LOCATION