Keith

Keith Products, Inc.
Environmental Control System for TH-67

Section	Component
21-50-00	System Description
21-50-01	Electrical
21-50-02	Plumbing
21-50-03	Compressor Assembly
21-50-04	Condenser Assy.
21-50-05	FWD Evaporator
21-50-06	AFT Evaporator
21-50-07	Charging and Troubleshooting

Maintenance Manual
With
Illustrated Parts List

Document No. 206-0102-4SM

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APR 27 2007
RELEASE DATE

List of Revisions

REV	DATE	DESCRIPTION	BY	APPROVED
Orig.	1/30/95	Original Release		
A	6/30/95			
B	4/19/96		KLS	
C	3/7/97		RH	
D	11/22/00	Incorporated Original Hardcopy to make electronic copy	JMS	HOA
E	11/27/00	Modified cover sht. to reflect changes Deleted "Record of Temp. Rev." page Replaced it with "List of Rev" page Updated title page, List of Eff. Pages, and record of Rev. page according to new revision. Added pages Record of Revisions and List of Service Bulletins Modified Table of Contents Pg 1 added Illustrated part to sect. "Air Cond…" Pg 2 spelling error was evaporator, now evaporator Modified entire document from air craft to rotorcraft Modified entire document labeling of figures and tables Modified entire document from polyol ester to polyolester 21-50-00 Pg 1 Sect. 2 was provided, now providing 21-50-01 Pg 1,Sect. 1, Para. 5 was parts, now Parts Pg 101 Sect. 3 "Note" was Troubleshooting, now troubleshooting Pg 102 Sect.,"Symptoms" #2 moved "operate" to be inline w/ other info. Pg 104 Sect. B moved section closer to table. Pg 501 Sect. 1 was the cooling , now the cooling	JMS	MAK

List of Revisions- Continued

REV	DATE	DESCRIPTION	BY	APPROVED
E		Sect. A renumbered getting rid of double 3"s Sect. A #4 was that, now then Added new #5 "check fuse (Item 17…." Modified #10 w/ " both sides of relay.." Added new item #11 "If now power…" Pg 502 Sect. B #3 & D #3 was ground present, now ground present and entire page was GND, now Gnd Pg 503 entire page was GND, now Gnd Pg 504,Sect. G #7 was know, now knob Sect. H #1 was Approximately, now approximately #2 was Switch, now switch Pg 505, Sect. "Dial Range" was in;, now in: Pg 1001 Modified Pict. upper left handside Pg 1004 Modified Pict. upper left handside 21-50-02 Pg 201, Sect. "Ref. No." was fro, now from Sect. "Note" was Hose Swaging Instruction, now hose swaging instruction Pg 1001 Modified pict. bottom, right handside now includes I/N 9 21-50-03 Pg 101, Sect. "Note" was to be trouble, now to trouble Sect. #1,2,3 relocated correction section to be inline with other sentences Pg 202, Sect. A #8 was Pg 204, now Pg 205 Pg 203, Sect. "Note" was is replaced, now is replaced Pg 204, Sect. D #1 was End, now end, #2 was are, now area Pg 205, Modified Pict. to represent correct Hardware 21-50-04 Pg 1, Sect. 1, Para 1 Modified it for clarity Para 2 was discussed, now discusses Pg 101, Sect. 1 was condenser blower, now condenser fan		

List of Revisions- Continued

REV	DATE	DESCRIPTION	BY	APPROVED
E		Sect. "Note" was to being trouble, now to trouble; was Shooting, now shooting Pg 201, Sect. #1 was Condenser, now condenser Sect. A #1 was Coil, now coil Pg 1001 Modified Pict. was #5, now #6 Pg 1002 Modified Table switched I/N 5 & 6 21-50-05 Pg 1, Para 2 was discussed, now discusses; was parts, now Parts Pg 101,Sect. "Note", was to being trouble, now to trouble; was Shooting, now shooting Sect. "A" #1 & "B" #2 was Operate, now Start operate Pg 1002 Label missing I/N 16, now JBS 240-2 21-50-06 Pg 1, Sect. 1, Last Para was parts, now Parts Pg 101, Sect. "A" #1 & "B" #2 was Operate, now Start operate Pg 103 I/N 1 was Evaportor, now Evaporator I/N 21 Modified title to fit in blocked area		
F	6-11-02	Added section 21-50-07. Revised 21-50-03 page 203 to exempt new compressor to the 10 minute run and oil check. Title page, removed repeated line, was: APPROVED BY: _____ Revised footer on List of Revisions, pg. 1 was List of Revisions now LIST OF REVISIONS. Pg. 2. Pg. 3 footer was, RECORD OF REVISIONS, now LIST OF REVISIONS. Added Pg. 4 to List of Revisions Modified date of REV. D on List of Revisions, was 11/2200, now 11/22/00.	JTD	MAK

F (cont.)		Revised footer for pg. 2 of List of Effective Pages, was TABLE OF CONTENTS, now LIST OF EFFECTIVE PAGES. Added pg. 3 to List of Effective Pages. Modified table of contents, pg. 2 to list new section 21-50-07. Changed pg. Number on section 21-50-01 was 502, now 501. Added SB169 and SB170 to List of Service Bulletins. Added torque value chart to 21-50-02 Page 202. Replaced Keith Product Inc. with Keith Products L. P.	JTD	MAK
G	11/04/03	Plumbing System BOM Item Number 10 was ES26104-2 now ES26104-1 (section 21-50-02, page 1002) Aft Evaporator Assembly BOM Item Number 20 was ES26104-2 now ES26104-1 (section 21-50-06, page 1003) Updated List of Service Bulletins (Page 1) Reason: Drafting Error per ER2275	RCB	MAK
H	03/17/05	Added JBS2020-9 to Section 21-50-01 pages 1001, 1002, 1003, 1004, 1005 and 1006 and to Section 21-50-02 pages 1001, and 1002. Reason: Service Difficulty Per ER2406.	LEO	MAK
J	08/01/06	Revised section 21-50-03 page 1002 I/N 13 WAS ES20033-29 NOW ES20033-27 Reason: Service Difficulty per ER3280	CDW	MAK
K	04/27/07	Edited I/N 5 on Pg. 1002 & 1005, Section 21-50-01: WAS JBS276-1 FWD Evap Fan NOW ES61062-2 Motor Edited I/N 15 on Pg. 1002, Section 21-50-05: WAS JBS276-1 NOW ES61060-2 Reason: Product Improvement per ER3499	AJ	MAK APR 27 2007 RELEASE DATE

RECORD OF REVISIONS

REV NO.	ISSUE DATE	DATE INSERTED	BY	REV NO.	ISSUE DATE	DATE INSERTED	BY
IR	01-30-95						
A	06-30-95						
B	04-19-96	04-19-96	KLS				
C	03-07-97	03-07-97	RH				
D	11/22/00	11/22/00	JMS				
E	11/27/00	11/27/00	JMS				
F	06/11/02	06/11/02	JTD				
G	11/04/03	11/04/03	RCB				
H	03/17/05	03/17/05	LEO				
J	08/01/06	08/01/06	CDW				
K	04/27/07	04/27/07	AJ				

LIST OF SERVICE BULLETINS

SERVICE BULLETIN NO.	DATE	SUBJECT	REVISION NO.	DATE INCORP.
SB170	5/30/00	Sight Glass	NC	
SB169	5/30/00	Condenser Blower	B	
SB196	3/17/05	Pressure Switch	NC	3/17/05

LIST OF EFFECTIVE PAGES

CHAPTER SECTION SUBJECT	PAGE	DATE
Title		April 27/07
List of Revisions	1	June 11/02
	2	June 11/02
	3	Nov 4/03
	4	April 27/07
Record of Revisions	1	April 27/07
List of Service Bulletins	1	Mar 17/05
List of Effective Pages	1	April 27/07
	2	April 27/07
	3	June 11/02
Table of Contents	1	June 11/02
	2	June 11/02
Introduction	1	Jan 30/95
	2	Jan 30/95
21-50-00	1	Nov 27/00
	2	June 30/95
	3	June 30/95
21-50-01	1	Nov 27/00
	101	Nov 27/00
	102	Nov 27/00
	103	June 30/95
	104	Nov 27/00
	105	June 30/95
	501	June 11/02
	502	Nov 27/00
	503	Nov 27/00
	504	Nov 27/00
	505	Nov 27/00
	1001	Mar 17/05
	1002	April 27/07
	1003	Mar 17/05
	1004	Mar 17/05

LIST OF EFFECTIVE PAGES

CHAPTER SECTION SUBJECT	PAGE	DATE
	1005	April 27/07
	1006	Mar 17/05
21-50-02	1	June 30/95
	201	Nov 27/00
	202	June 11/02
	601	June 30/95
	1001	Mar 17/05
	1002	Mar 17/05
21-50-03	1	Mar 07/97
	101	Nov 27/00
	102	Mar 07/97
	201	Nov 27/00
	202	Nov 27/00
	203	June 11/02
	204	Nov 27/00
	205	Nov 27/00
	1001	June 30/95
	1002	August 01/06
21-50-04	1	Nov 27/00
	101	Nov 27/00
	201	Nov 27/00
	1001	Nov 27/00
	1002	Nov 27/00
21-50-05	1	Nov 27/00
	101	Nov 27/00
	201	June 30/95
	1001	June 30/95
	1002	April 27/07
21-50-06	1	Nov 27/00
	101	Jan 30/95
	201	June 30/95
	1001	June 30/95
	1002	June 30/95
	1003	Nov 4/03
	1004	June 30/95

CHAPTER SECTION SUBJECT	PAGE	DATE
21-50-07	1	June 11/02
	2	June 11/02
	101	June 11/02
	102	June 11/02
	201	June 11/02
	202	June 11/02
	203	June 11/02
	204	June 11/02

TABLE OF CONTENTS

TABLE OF CONTENTS

INTRODUCTION

1. PURPOSE

   The purpose of this Maintenance Manual is to provide detailed instructions for the troubleshooting, checking and maintaining of the Keith Products, L. P. air conditioning system for the Bell Model 206B helicopter as modified to the TH-67 for the U. S. Army.

   The Keith Products air conditioning system is installed in accordance with STC SH1504NM. TH-67 is a military designation for Bell 206B Helicopter S/N 5101 thru 5237 with STC's SH582GL, SH7638SW, and SH8938SW accomplished.

2. SCOPE

   The scope of the service and maintenance manual provides the maintenance technician with detailed information covering:

   - Overall system level description and theory of operation.
   - Component level description and theory of operation.
   - Component checking and troubleshooting procedures.
   - Maintenance practices to keep the environmental control system operating at its maximum efficiency.
   - The identification of special equipment to accomplish the specific tasks.
   - An Illustrated Parts List (IPL) covering the breakdown of each major component of the air conditioning system, including part number and relevant illustrations.

3. ARRANGEMENT

   This Maintenance manual is arranged in accordance with Air Transport Association (ATA) Specification 100 and includes an Illustrated Parts List.

4. GLOSSARY

Nonstandard abbreviations and symbols used in the Maintenance Manual are described below.

Abbreviations:

A/R	-	As Required
Assy.	-	Assembly
Comm. Avail	-	Commercially Available
Evap	-	Evaporator
FWD	-	Forward
Gnd	-	Ground
GPU	-	Ground Power Unit
PL	-	Illustrated Parts Catalog
STC	-	Supplemental Type Certificate
SW	-	Switch
VDC	-	Volts Direct Current

AIR CONDITIONING SYSTEM – SYSTEM DESCRIPTION

1. GENERAL

The air conditioning system for the TH-67 helicopter consists of a refrigerant R134a vapor cycle cooling system. This system allows the pilot to control cooling for a comfortable rotorcraft cabin. Figure 1 shows a general arrangement of the air conditioning system.

The pilot's overhead control panel contains the bleed air heat OFF/MAX switch. The instrument panel contains the cooling system ON/OFF switch, the fan OFF/LOW/HIGH switch, and a cabin-cooling rheostat.

2. COOLING SYSTEM

The cooling or air conditioning system, as designed and manufactured by Keith Products for the TH-67 helicopter, is a vapor cycle type cooling system using refrigerant R134a. The electrical portion of the system is operated using the rotorcraft 28 VCD electrical system and is operable in all normal flight modes. Air conditioning may be operated with the engine operating and the rotorcraft electrical system providing 28 VDC to the main buss.

The major components of the system are the compressor, condenser assembly with blower, and two evaporator/cabin blower units. Refrigerant plumbing and electrical systems connect the major component to provide a closed loop system.

The compressor is mounted in the engine compartment and is driven by the tail rotor drive shaft accessory pulley via a "V" type belt. The compressor takes low pressure refrigerant gas and compresses it to a higher pressure and temperature.

The condenser is located above the baggage compartment area and includes a condenser coil and blower. The condenser cooling air (ambient air) is drawn in through a cutout in the fuselage skin on the left side of the rotorcraft and passes through the condenser coil to remove heat from the system. After passing through the condenser coil, the air is exhausted to the outside through an exhaust duct also located on the left side of the rotorcraft.

Two evaporator/blower units are located within the helicopter interior. The aft evaporator, located aft of the rear passenger's seat, provides cooling airflow for the cabin area of the interior. The forward evaporator is located forward of the instrument panel and provides cooling airflow to the flight crew through two panel mounted air outlets. Both evaporators are of a design wherein the cabin air is drawn into the evaporator coil and the fan then delivers the conditioned air to the cabin. This recirculating system continues to dry and cool the air each time it passes through the evaporator. Moisture removed from the air by the cold coil (condensate) is collected within the evaporator housing and is drained overboard. Each evaporator is equipped with a thermal expansion valve which regulates the amount of refrigerant entering the coil to provide optimum cooling effect. The evaporator blowers can be operated in the "FAN" position to recirculate cabin air without cooling. Both blowers are operated from the same fan speed control.

The plumbing which connects the compressor, condenser, and the evaporator consists of rubber-based hoses with a nylon barrier. The fittings are permanently swaged onto the hoses. All fittings are "o-ring" type connections with sealant on the fitting mating surfaces to prevent refrigerant leaks. Two R134a service valves are located in the area above the baggage compartment. They are sized differently to avoid incorrect cross connecting when gaining access to the plumbing for system recharging.

Temperature control is accomplished through a rheostat to set desired cooling air temperature. Two temperature sensors wired in series and located in the aft evaporator inlet, provide the input signal to the temperature controller. The temperature controller cycles the compressor clutch, as necessary, to achieve the selected cabin temperature. System safety features include an evaporator freeze switch that inhibits the compressor clutch when the evaporator air outlet temperature is cold enough to form condensate ice build up.

The entire air conditioning refrigerant loop is protected against over pressure conditions by to separate safety devices. The first device is a binary high/low pressure switch that activates in the event of an overpressure and is located in the service valve behind the baggage compartment bulkhead. This switch will open at approximately 350 PSIG and will interrupt power to the compressor clutch at which point the system pressures will drop. The switch will also interrupt power to the compressor clutch under low pressure conditions. The second overpressure safety device is a fuse plug which will vent the system refrigerant in the event of a system pressure in excess of 425 PSIG. It is located on the receiver/drier.

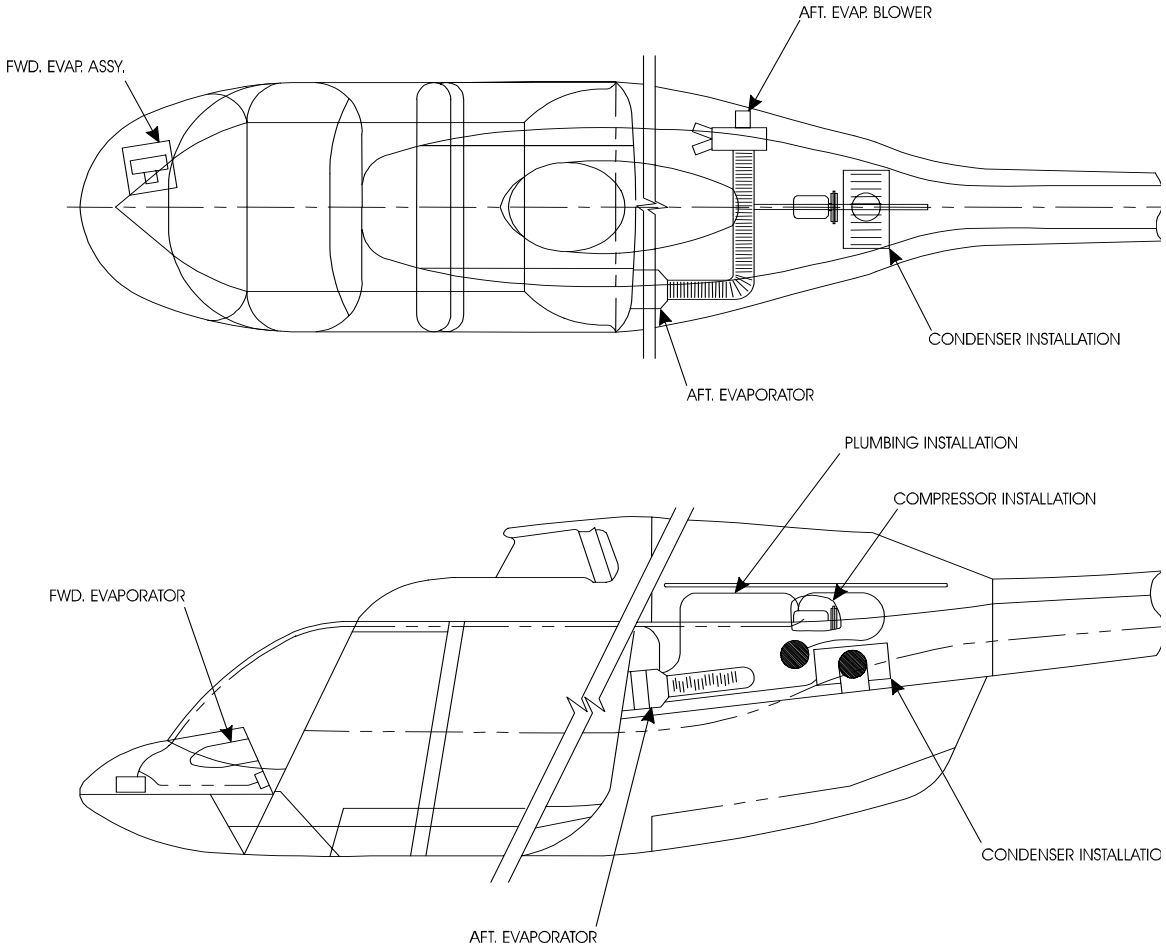

Figure 1
Air-Conditioning System General Arrangement
Sheet 1

ELECTRICAL

DESCRIPTION AND OPERATION

1. GENERAL

The air conditioning system consists of one vane axial condenser fan, one centrifugal evaporator blower for each evaporator assembly, and a temperature controller with rheostat. The system is controlled by a mode switch with Air Conditioning Off and Fan Only position. The evaporator fan has a high and low position switch. The system incorporates a binary pressure switch to sense an over pressure or under pressure condition in the system. A freeze switch that measures the aft evaporator air outlet temperature cycles the compressor clutch to off to prevent ice forming on the coil.

Two temperature sensors wired in series and located in the aft evaporator inlet, provide cabin temperature information to the temperature controller. A rheostat also provides input to the controller. The controller takes these signals and cycles the compressor clutch as necessary to provide the desired cabin temperature.

The system is protected by a 30 amp fan breaker and a 35 amp air cond breaker.

For rotorcraft equipped with a two pilot IFR system, the electrical system will shed the load of the air conditioning system blowers in the event of a main generator failure. Once main generator power is restored, the air conditioning system will automatically return to operation. A 50 amp current limiter provides additional circuit protection for the system.

This section of the maintenance manual describes the electrical system and presents electrical troubleshooting and adjustment/test procedures. An Illustrated Parts List is included in Figure 1.

TROUBLESHOOTING

1. GENERAL

The following procedures are used for troubleshooting the electrical system and the electrical interfaces with the other assemblies of the air conditioning system.

2. TOOLS AND EQUIPMENT

Designation	Ref. No.	Qty.	Remarks
Service Pressure Gauge	Comm Avail.	1	None
Multi-meter	Comm. Avail.	1	None
28vdc Source		A/R	None

3. ELECTRICAL TROUBLESHOOTING PROCEDURES (REF. IPL Fig. 1)

NOTE: Always attach a service gauge set to system prior to beginning troubleshooting to insure proper refrigerant charge is present.

A. Cooling Problems.

The following tables outline electrical system problems and solutions for no cooling, reduced cooling, or unwanted cooling**.**

SYMPTOMS	COMPONENT	FAILURE MODE	ADDITIONAL TESTS
No Cooling and: 1. Clutch does not engage, and, 2. Condenser blower motor does not operate.	"AIR COND." CIRCUIT BREAKER	OPEN	
	AIR COND. SWITCH	"AIR COND" Pole OPEN	
	FUSE ON A/C SWITCH "A.C." POLE	OPEN	
No Cooling and: 1. Cooling Control Rheostat set on "MAX"	COOLING RHEOSTAT	OPEN	
	Evap. Temp. Probe(s)	OPEN	Total resistance should be 8670 ohms @ 60º F, 4952 ohms @ 80º F
	TEMP. CONTROLLER	SHORT (#2 PIN)	See Temp Controller check procedure
No Cooling and: 1. Clutch does not engage	Clutch Relay	OPEN (Output)	
	Evap. Freeze Switch	OPEN (or out of adjustment)	Should close at 36º F
	Pressure Switch – High Limit	OPEN	Should be closed at 350 ± 30 psig at compressor discharge
	Pressure Switch – Low Limit	OPEN	Should be closed at 22 ± 7 psig
	Clutch Dropping Resistor	OPEN	
	Clutch Coil	OPEN	Replace compressor
	Clutch Fuse	OPEN	

SYMPTOMS	COMPONENT	FAILURE MODE	ADDITIONAL TESTS
No Cooling and: 1. "AIR COND" CIRCUIT BREAKER OPENS	Condenser Blower Motor	SHORT	
No Cooling and: 1. No Airflow, and 2. No Motors OPERATING, and 3. Clutch disengaged	"FAN" CIRCUIT BREAKER	OPEN	
No Cooling and: 1. Clutch does not engage, and fuse (item 17) is blown	CLUTCH COIL	SHORT	
No Cooling and: 1. No airflow from FWD or AFT evap, and 2. FAN SWITCH ON "HI", and 3. A.C. switch on "ON" or "FAN", and 4. "FAN" circuit breaker opens	FWD or AFT EVAPORATOR FAN MOTOR	SHORT	See Evap Fan Check
No Cooling and: 1. No airflow from fwd or aft evaporator fan	FWD or AFT EVAPORATOR FAN MOTOR	OPEN	See Evap Fan Check
No Cooling and: 1. Fuse on "AIR COND" pole of A.C. switch is blown	Condenser Blower Motor Relay	SHORT	
	Clutch Relay	SHORT	

SYMPTOMS	COMPONENT	FAILURE MODE	ADDITIONAL TESTS
No Cooling and: 1. Condenser Blower Motor does not operate	Condenser Blower Relay	OPEN (input)	
		OPEN (output)	
	Condenser Blower Motor	OPEN	
Reduced Cooling and Air Flow: 1. System operational	Freeze Switch	Setting	Adjust “Freeze Switch” Setting
Excessive Cooling and: 1. Cooling Control Rheostat Inoperative	Cooling Rheostat	SHORT	
	Evap. Temp. Probe(s)	SHORT	
	Temp. Controller	OPEN (#2 PIN)	See “Temp Controller” Check Procedure
	Clutch Relay	OPEN (input)	
		SHORT (output)	
Unwanted Cooling and: 1. Air Cond. Switch on “OFF” or “FAN”	Air Cond. Switch	SHORT (“AIR COND” POLE)	

B. Airflow Problems.
The following tables outline electrical system problems and solutions for no air-flow or excessive air flow.

SYMPTOMS	COMPONENT	FAILURE MODE	ADDITIONAL TESTS
No Airflow and: 1. No cooling, and 2. Both Evap. Fans Inoperative	Air condition Switch	"FAN" POLE OPEN	
No Airflow from FWD and AFT Evap and: 1. No cooling, and 2. "FAN" Circuit Breaker open, and 3. Fan switch on "HI" setting	FWD or AFT Evap. Fan Motor	SHORT	See Evap Fan Check
No Airflow from FWD and AFT Evap and: 1. Reduced cooling	FWD or AFT Evap. Fan Motor	OPEN	See Evap Fan Check
No Airflow from FWD and AFT Evap and: 1. No cooling, and 2. No motors or clutch operating	"FAN" Circuit Breaker	OPEN	
No Airflow on "LO" Fan Switch setting	Fan Switch	OPEN ("LO" POLE)	
No Airflow on "HI" Fan Switch setting	Fan Switch	OPEN ("HI" POLE)	
No Airflow from FWD and AFT Evap on "LO" Fan Setting	Fan "Low speed" or "Dropping" Resistor on FWD or AFT Evap	OPEN	See Evap Fan Check
Excessive Airflow from both evaps on "LO" Fan Setting	Fan Switch	SHORT ("HI" POLE)	
Unwanted Airflow from both evaps and: 1. Air Cond. Switch is on "OFF"	Air Cond. Switch	SHORT ("FAN" POLE)	
Condenser Blower Motor Operates and: 1. Clutch is engaged, and 2. Air Cond. Switch is "OFF" or "FAN"	Condenser Blower Motor Relay	SHORT (Output)	

ADJUSTMENT / TEST

1. GENERAL

The following procedures are used for testing and checking the electrical system and the electrical interfaces with the other assemblies of the cooling or air conditioning system.

2. TOOLS AND EQUIPMENT

Designation	Ref. No.	Qty.	Remarks
Service Pressure Gauge	Comm Avail.	1	None
Multi-meter	Comm. Avail.	1	None
28vdc Source		A/R	None

3. ELECTRICAL TEST PROCEDURES (REF. IPL Fig. 1)

Listed below are tests or checks that can be accomplished to help resolve the troubleshooting symptoms on page 101.

A. Air Condition Selected, Compressor Clutch Will Not Engage.
   1. Connect service pressure gauge to service ports located behind the baggage compartment bulkhead.
   2. Connect ground power to rotorcraft.
   3. Check that the AIR COND and FAN C/B's are closed.
   4. Select air conditioning system to On
   5. Check that minimum static system pressure is greater than 50 psig.
   6. Check fuse (Item 17). Replace if necessary.
   7. Check for power at clutch coil. If present, check that ground wire is securely attached
   8. If clutch still will not work properly, check clutch coil air gap per 21-50-03, page 201
   9. If no power is present at clutch coil, check for power at both sides of pressure switch. If power is present on relay side of switch (with static pressure • 50 psig), replace switch.
   10. If no power is present at pressure switch, check for power at both side of relay (Item 9). If power is present on freeze switch side, replace relay.
   11. If no power is present at relay, check power at both sides of freeze switch. If power is present on fuse, side, replace freeze switch.

B. FWD Evaporator Blower will not operate in high or low speed.
   1. Connect ground power to rotorcraft.
   2. Select air conditioning system to ON.
   3. Check if power and ground are present at fan wire splices and Gnd terminal strip. If power and ground are present, blower motor (Ref. 21-50-05 IPL Fig. 1, item 15) has failed.
   4. Select air conditioning OFF, remove electrical power.
   5. Remove blower assy from rotorcraft. Remove the four screws attaching the motor to the housing. Using a 1/8 allen wrench remove blower wheel (use extreme care not to bend blower wheel). Cut power wires at splice and remove Gnd wire from Gnd terminal. Install new motor in reverse order.

C. FWD Evaporator Blower will not operate in the low speed setting.
   1. Connect ground power to rotorcraft.
   2. Select air conditioning system to ON
   3. Check if power is present at wire 206-1709-N52 (at splice). If power is present, the low speed resistor (Ref. 21-50-05 IPL Fig. 1, item 16) has failed.
   4. Select air conditioning OFF, remove electrical power.
   5. Remove blower assembly and using a #21 drill remove the two rivets securing the resistor. Cut the wires at the splice and remove Gnd wire from Gnd terminal. Install new resistor in reverse order.

D. AFT Evaporator Blower will not operate in high or low speed.
   1. Connect ground power to rotorcraft.
   2. Select air conditioning system to ON.
   3. Check if power and ground are present at fan wire splices and Gnd terminal strip. If power and ground are present, blower motor (Ref. 21-50-06 IPL fig. 1, item 57) has failed.
   4. Select air conditioning OFF, remove electrical power.
   5. Remove blower assy from rotorcraft.

E. AFT Evaporator Blower will not operate in the low speed setting.
   1. Connect ground power to rotorcraft.
   2. Select air conditioning system to ON.
   3. Check if power is present at wire 206-1709-N6 (at electrical panel). If power is present, the low speed (dropping) resistor (Ref. Item 12) has failed.
   4. Select air conditioning OFF, remove electrical power
   5. Remove resistor located in electrical panel. Install new resistor in reverse order.

F. Condenser Blower will not operate.
   1. Connect ground power to rotorcraft.
   2. Select air conditioning system to ON.
   3. Check if power is present at wire 206-1709-N57 (at electrical panel). If power is present, the fan motor (Ref. 21-50-04 IPL Fig. 1, item 4) has failed.
   4. Select air conditioning OFF, remove electrical power.
   5. Remove blower assembly. Remove the power wire at the blower terminal and remove Gnd wire from Gnd terminal. Install new blower in reverse order.

G. Temperature Controller Check Procedure

Note: The following procedure allows the checking of the operation of the temperature controller while leaving it installed and wired in the rotorcraft.

1. Conduct an ohmmeter check of the cooling control rheostat mounted on the ECS control panel and of the temperature sensors located in the evaporator air inlet lip. The following chart gives the correct resistance values for the conditions shown. The temperature probes are wired in series and the resistance reading is made across both sensors.

COMPONENT	CONDITION	RESISTANCE (OHMS)
RHEOSTAT	"MIN" SETTING	1500
	"MAX" SETTING	0
TEMP. SENSORS	60º EVAP. INLET AIR	8670
	80º EVAP. INLET AIR	4952

Note: To check the trip point temperature of the controller, the temperature of the air entering the evaporator must be between 60º F and 70º F.

2. Attach the voltmeter (+) lead to either end terminal of the 206-1709-N19 wire and ground lead to rotorcraft structure.

3. Place a thermometer in the evaporator air inlet.

4. Set the fan switch on “LO” and the air conditioner switch on “AIR COND.”

5. Rotate the cooling control from “MIN” to “MAX”. The voltage reading should jump from zero to battery voltage during the rotation.

6. Rotate the control fan from “MAX” to “MIN” and the voltage should drop from battery voltage back to zero.

7. The position of the rheostat knob at which the voltage jumps will vary with the evaporator inlet air temperature. See the following chart for trip points.

AIR TEMPERATURE	RHEOSTAT SETTING
70º	“MIN”
80º	“MAX”

H. Freeze Switch Adjustment

Note: The normal setting for this application is to align the scribe line on the cam with the scribe line on the case. However, under certain extreme climatic conditions the freeze switch may not function, thus continuing to allow the compressor to run. Build up of ice on the evaporator coil fins can result and reduce air flow and cooling.

1. Adjust cam CCW to increase the temperature set point. approximately 8º of angular cam rotation (CCW) will increase the temperature set point 1º F higher.
2. The chart below illustrates the temperature ranges for the freeze switch. The switch is originally set to the NORMAL setting.

DIAL POSITION	TERMINAL #2 COMMON			
	TERM 2-1 BREAK AT	TERM 2-1 MAKE AT	TERM 2-3 BREAK AT	TERM 2-3 MAKE AT
COLD	20ºF	12ºF	12ºF	20ºF
NORMAL	38ºF	30ºF	30ºF	38ºF
WARM	56ºF	48ºF	48ºF	56ºF

Switch:
1. Snap-acting S.P.D.T.
2. #2 Terminal is common.
3. #3 Terminal makes on temperature rise.
4. #1 Terminal breaks on temperature rise.

Dial range: Coldest out to warmest in: 12º F to 60º F

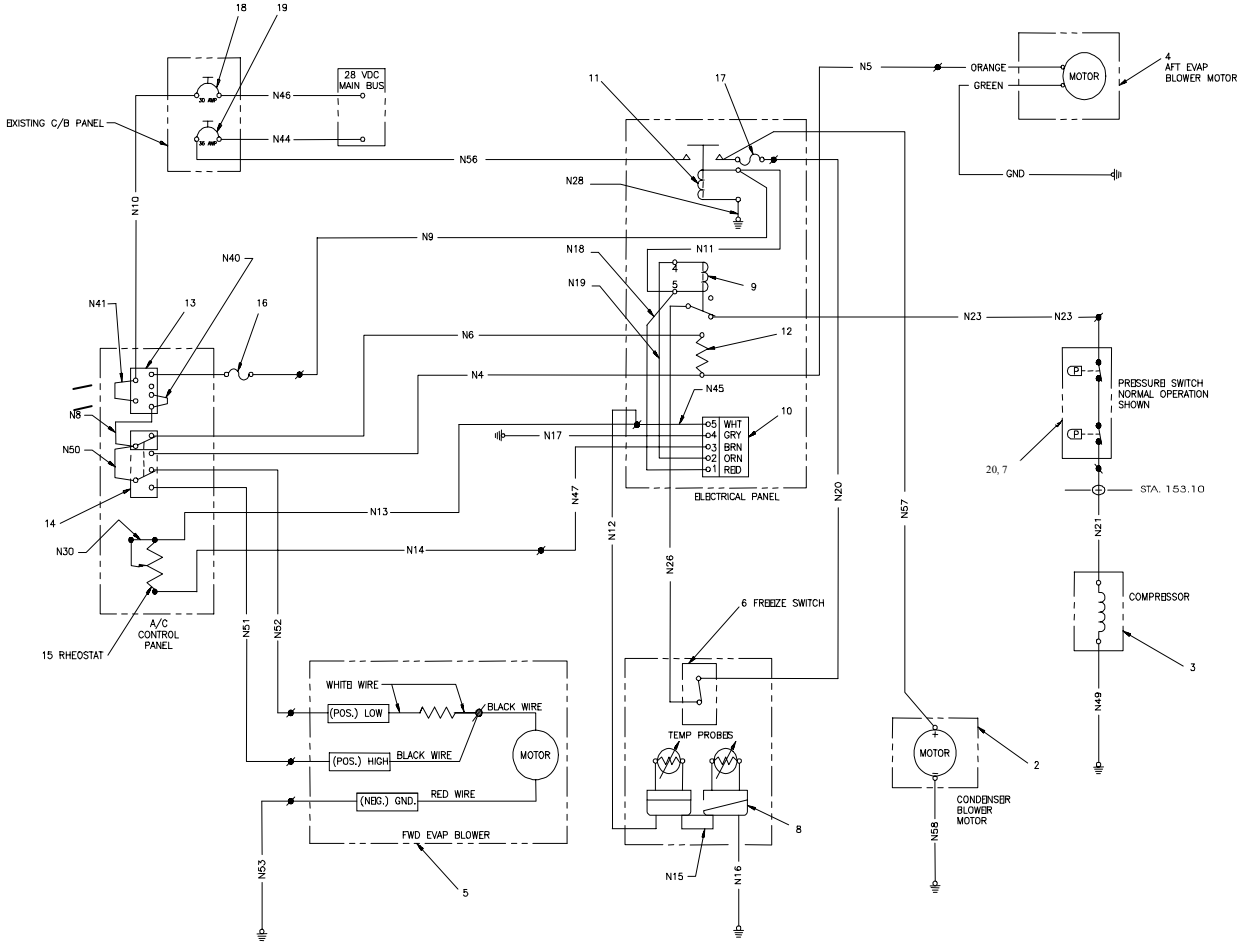

Figure 1
Electrical System VFR Rotorcraft
Sheet 1 of 3

FIG. ITEM	PART NUMBER	NOMENCLATURE	EFFECT	UNITS PER ASSY
1 1	206-0703-1	Electrical Installation		RF
2	ES73127-2	Condenser Blower Motor		1 ref
3	JBS220-1	Compressor		1 ref
4	JBS13002-1	AFT Evap Fan		1 ref
5	ES61060-2	Motor		1 ref
6	JBS60-2	Freeze Switch		1 ref
7	JBS2020-5	Pressure Switch	Note 1	1 ref
8	ES52126-1	Temp Sensor Probes		2 ref
9	ES56128-1	Relay, Clutch		1
10	ES62117-1	Temp Controller		1
11	ES56149-1	Relay, Cond Blower		1
12	ES63014-7	Resistor, Aft Evap Fan Dropping		1
13	ES57016-5	Switch, AC ON – OFF		1
14	ES57016-8	Switch, Fan Speed		1

IPL Figure 1
Air Conditioning System – Electrical System VFR Rotorcraft
Sheet 2 of 3

FIG. ITEM	PART NUMBER	NOMENCLATURE	EFFECT	UNITS PER ASSY
15	ES62114-1	Rheostat		1
16	JBS79-8	Fuse Assy		1
17	JBS79-6	Fuse Assy		1
18	JBS75-8	Circuit Breaker – 30A, “FAN”		1
19	JBS75-28	Circuit Breaker – 35A, “A/C”		1
20	JBS2020-9	Pressure Switch	Note 1	1 ref

Note 1: JBS2020-9 supersedes JBS2020-5.

IPL Figure 1
Air Conditioning system – Electrical System VFR Rotorcraft
Sheet 3 of 3

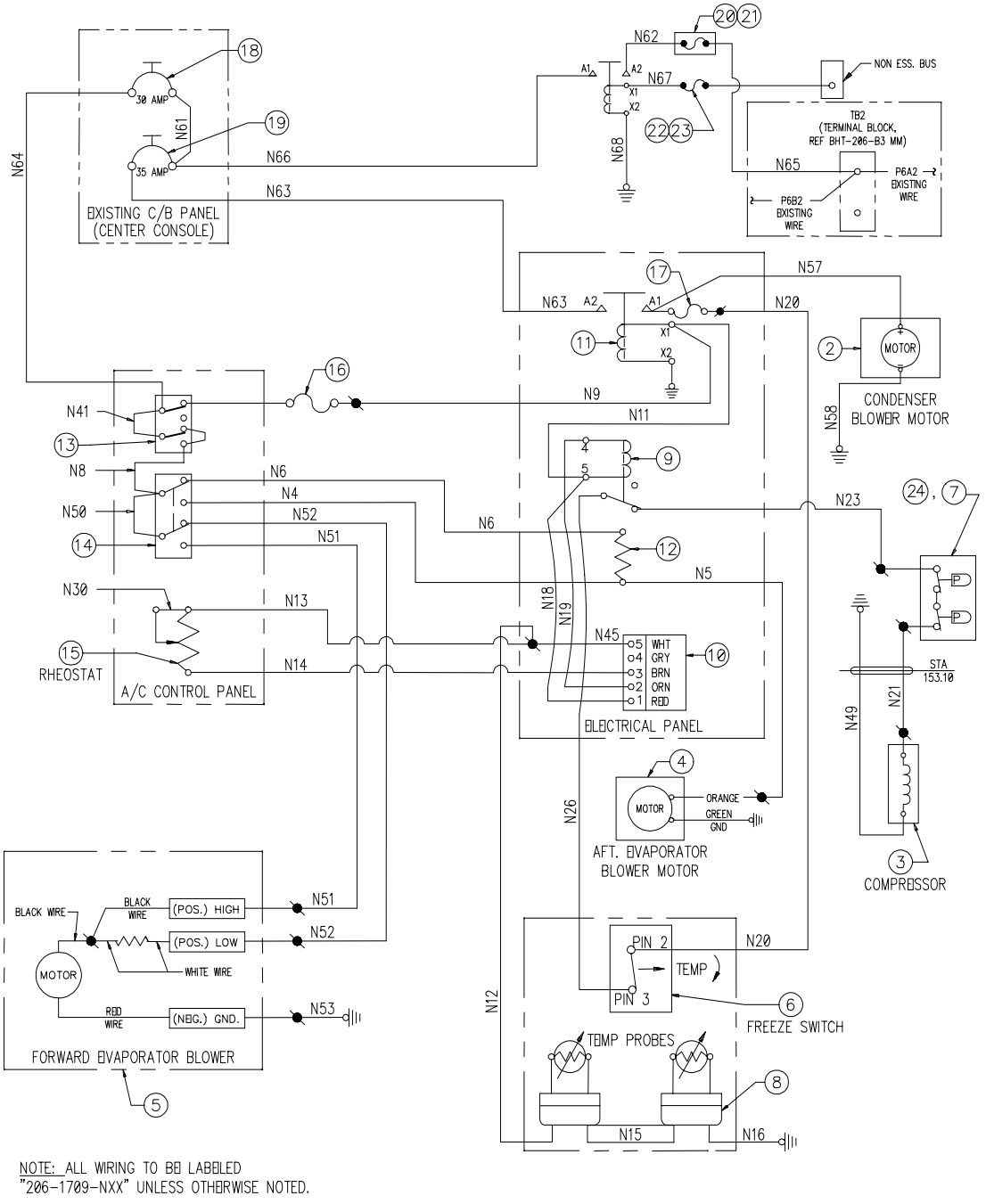

Figure 2
Electrical System IFR Rotorcraft
Sheet 1 of 3

FIG. ITEM	PART NUMBER	NOMENCLATURE	EFFECT	UNITS PER ASSY
2 1	206-0703-1	Electrical Installation		RF
2	ES73127-2	Condenser Blower Motor		1 ref
3	JBS220-1	Compressor		1 ref
4	JBS13002-1	AFT Evap Fan		1 ref
5	ES61060-2	Motor		1 ref
6	JBS60-2	Freeze Switch		1 ref
7	JBS2020-5	Pressure Switch	Note 1	1 ref
8	ES52126-1	Temp Sensor Probes		2 ref
9	ES56128-1	Relay, Clutch		1
10	ES62117-1	Temp Controller		1
11	ES56149-1	Relay, Cond Blower		1
12	ES63014-7	Resistor, Aft Evap Fan Dropping		1
13	ES57016-5	Switch, AC ON – OFF		1
14	ES57016-8	Switch, Fan Speed		1

IPL Figure 2
Air Conditioning System – Electrical System IFR Rotorcraft
Sheet 2 of 3

FIG. ITEM	PART NUMBER	NOMENCLATURE	EFFECT	UNITS PER ASSY
15	ES62114-1	Rheostat		1
16	JBS79-8	Fuse Assy		1
17	JBS79-6	Fuse Assy		1
18	JBS75-8	Circuit Breaker – 30A, “FAN”		1
19	JBS75-28	Circuit Breaker – 35A, “A/C”		1
20	ES51058-3	Current Limiter		1
21	ES51059-1	Limiter Block		1
22	ES51061-1	Fuse Holder		1
23	JBS64-1	Fuse		1
24	JBS2020-9	Pressure Switch	Note 1	1 ref

Note 1; JBS2020-9 supersedes JBS2020-5.

IPL Figure 2
Air Conditioning System – Electrical System IFR Rotorcraft
Sheet 3 of 3

PLUMBING

DESCRIPTION AND OPERATION

1. GENERAL

The plumbing system consists of a flexible nylon lines refrigerant hose with permanent swaged on fittings. All connections are tube O-ring type with sealant on the fitting mating surfaces to ensure leak free operation. Hose, O-ring material, and sealant are specially designed to work with refrigerant R134a and polyolester oils. Two service valves are located in the equipment area above the baggage compartment. They are sized differently to avoid incorrect cross connecting when gaining access to the plumbing for system recharging. A receiver/drier is installed downstream of the condenser to remove moisture from the liquid refrigerant. A binary pressure switch monitors the refrigerant gas pressure. This switch will open at a condenser over pressure of 350 psi and under pressured conditions of 30 psi. This will interrupt the power to the compressor clutch and stop the compressor.

This section of the maintenance manual discusses checks and maintenance practices used for the plumbing portion of the air conditioning system. An Illustrated Parts List is included in Figure 1.

MAINTENANCE PRACTICES

1. GENERAL

The following procedures are used to perform typical maintenance on the air conditioning system plumbing.

2. TOOLS AND EQUIPMENT

Designation	Ref. No.	Qty.	Remarks
R134a Compatible Hose Swaging Kit	Available from Keith Products	1	None
Sharp Knife	Comm. Avail.	1	None
Impact Wrench	Comm. Avail.	1	None
Polyolester Oil	Comm. Avail.	A/R	Viscosity Grade 68
Sealant	ES49000-1	A/R	None

3. PLUMBING MAINTENANCE PROCEDURES (REF. IPL Fig. 1)

A. Hose or Fitting Replacement

NOTE: If it is found that a hose or fitting has a leak, it will be necessary to replace the entire hose assembly. Follow the Hose Swaging Instruction below:

1. Hose should only be cut with a sharp knife. (**Note:** Use of serrated blades or saws to cut hose will leave particles that can contaminate system).
2. Insert the proper size die in the swaging tool.
3. Insert fitting in swaging tool so that it is centered in the die and hand tighten.
4. Insert hose in fitting until it bottoms (**Note:** Indicating hole is in base of fitting).
5. Using impact wrench, tighten nut until die housings contact. (**Note:** It is important to keep hose pushed into fitting while swaging).
6. Reverse impact and back off nut until housing contacts rubber stops.

B. Connection to Components – O-Ring Replacement
1. Place the appropriate o-ring (REF. IPL Fig. 1) over the tube “O” end of the fitting.
2. Lubricate o-ring with polyolester oil prior to assembly.
3. Apply sealant to all fitting mating surfaces prior to assembly.

C. Receiver/Drier Replacement
1. Replace receiver/drier whenever the compressor is replaced or when the air conditioning system plumbing is left open to the atmosphere for a time greater than 1 hour.

D. Refrigerant Charge
1. Charge air conditioning system using a R-134a service cart in accordance with the manufacturers instructions. Use a refrigerant charge of 2.5 lbs as a baseline and charge until the sight glass is clear of bubbles.

E. Torque values for hose fittings:

Thread Size	**Ft-Lb**	**N-M**
5/8”	11-13	15-18
3/4"	15-20	20-27
7/8”	21-27	29-37
1 1/16”	28-33	38-45

INSPECTION/CHECK

1. GENERAL

The following procedures are used for checking and inspecting the air conditioning system plumbing.

2. TOOLS AND EQUIPMENT

Designation	Ref. No.	Qty.	Remarks
Electronic R134A Refrigerant Leak Detector	Comm. Avail.	1	None

3. PLUMBING CHECK PROCEDURES (REF. IPL Fig. 1)

A. Plumbing Installation Preventive Maintenance Check

NOTE: All O-rings should be lubricated with polyolester oil or sealant applied to all fittings mating surfaces before assembly.

1. Check that all hoses are properly supported and do not chafe. Check that all clamps remain secure and that the hose and fitting are well supported at connections with fixed units such as evaporator, condenser, etc., to prevent fatigue cracking in tubing headers or fittings.

B. Plumbing System Refrigerant Leak Check

1. Connect service pressure gauge set to service ports, located behind the baggage compartment bulkhead.
2. Check that the gauges are reading the proper static pressure. Both gauges should read approximately 55 psig @ standard temperature (59ºF) with a properly charged system when the system is not operating.
3. Using leak detector, check entire plumbing system including hose fittings and coil assemblies for leaks. There shall be no leaks. Repair or replace leaking component per the appropriate maintenance manual section and its IPL.

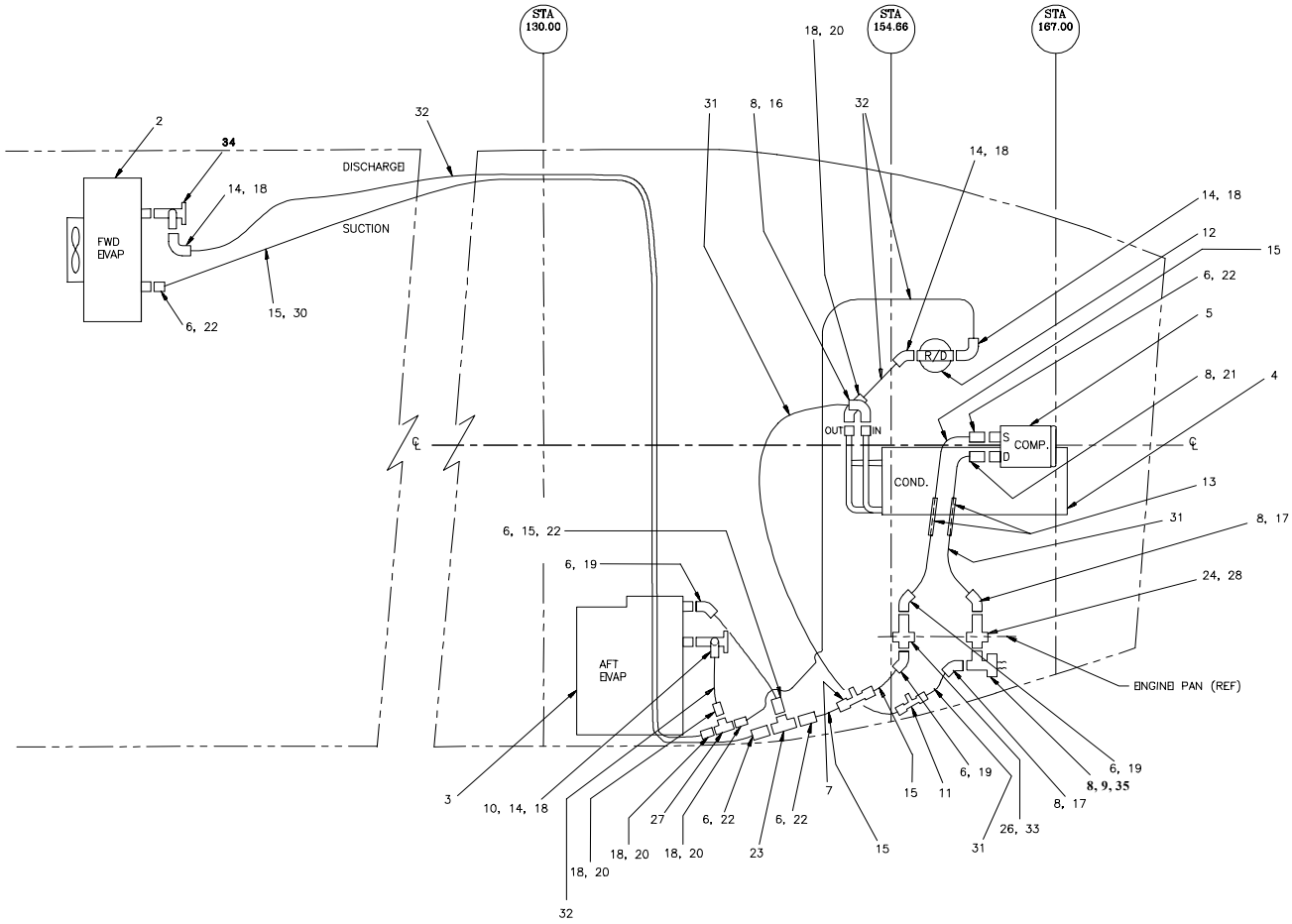

Figure 1
Plumbing System
Sheet 1 of 2

FIG.	ITEM	PART NUMBER	NOMENCLATURE	EFFECT	UNITS PER ASSY
1	1	206-0752-3	Plumbing Installation		RF
	2	JBS2003-4	FWD Evaporator		1 ref
	3	JBS2005-2	AFT Evaporator		1 ref
	4	206-1351-2	Condenser		1 ref
	5	JBS220-1	Compressor		1 ref
	6	ES49011-3	O-ring		8
	7	ES40158-3	Service Valve		1
	8	ES49011-2	O-ring		5
	9	JBS2020-5	Pressure Switch	Note 1	1
	10	ES26104-1	Expansion Valve		1 ref
	11	ES40158-2	Service Valve		1
	12	ES43030-2	Receiver/Drier		1
	13	ES02126-2	Fire Sleeve		42 in
	14	ES40151-1	90º Fitting		4
	15	ES48149-3	Hose		360 in
	16	ES40151-2	90º Fitting		1
	17	ES40150-2	45º Fitting		2
	18	ES49011-1	O-ring		8
	19	ES40150-3	45º Fitting		3
	20	ES40149-1	Fitting		4
	21	ES40149-2	Fitting		1
	22	ES40149-3	Fitting		5
	23	ES41061-2	Tee Fitting		1
	24	JBS915-1	Bulkhead Fitting		1
	26	JBS915-2	Bulkhead Fitting		1
	27	ES41061-1	Tee Fitting		1
	28	AN924-8D	Nut		1
	30	ES06022-1	Insulation Tape		700 in
	31	ES48149-2	Hose		60 in
	32	ES48149-1	Hose		336 in
	33	AN924-10D	Nut		1
	34	ES26104-1	Expansion Valve		1 ref
	35	JBS2020-9	Pressure Switch	Note 1	1

Note 1: JBS2020-9 supersedes JBS2020-5.

IPL Figure 1
Air Conditioning System – Plumbing System
Sheet 2 of 2

COMPRESSOR ASSEMBLY

DESCRIPTION AND OPERATION

1. GENERAL

The compressor assembly is driven from the tail rotor drive shaft and is mounted in the engine compartment. The unit consists of a compressor, compressor mount, support hardware and a pressure switch. The compressor is driven via a single V flat belt, and compresses the refrigerant gas at which it will condense at ambient temperatures. This gas is directed to the condenser where its heat is removed by air flow from the condenser fan.

This section of the maintenance manual discusses troubleshooting and maintenance practices used for the compressor assembly portion of the air conditioning system. An Illustrated Parts List is included in Figure 1.

TROUBLESHOOTING

1. GENERAL

   The following procedures are used for troubleshooting the compressor assembly.

2. TOOLS AND EQUIPMENT

Designation	Ref. No.	Qty.	Remarks
Service Pressure Gauge	Comm. Avail.	1	None
28vdc Source		A/R	None

3. COMPRESSOR TROUBLESHOOTING PROCEDURES (REF. IPL Fig. 1)

   With the air conditioning system operating, do any of the following conditions occur:

   NOTE: Always attach a service gauge set to system prior to trouble shooting to insure proper refrigerant charge is present.

Trouble	Probable Cause	Correction
1. Unusually high suction pressure with low discharge pressure	Internal problem compressor body.	Replacement compressor
2. Unusually low suction and discharge pressure	System or compressor Leak.	Repair leak or replace compressor.
3. Clutch disengagement “chattering’, intermittent or inoperative.	(a) Improper clutch air gap. (b) Defective clutch coil.	(a) Remove compressor and adjust air gap. (b) Remove compressor and replace clutch coil.
4. Rough running.	Internal compressor problem.	Replace compressor.

Trouble	Probable Cause	Correction
5. Unusual noise, clutch engaged.	(a) Improper clutch air gap.	(a) Remove compressor and adjust air gap.
	(b) Defective clutch coil.	(b) Remove compressor and replace clutch coil.
	(c) Worn bearing.	(c) Replace compressor.

MAINTENANCE PRACTICES

1. GENERAL

   The following procedures are used to perform typical maintenance on the compressor assembly.

2. TOOLS AND EQUIPMENT

Designation	Ref. No.	Qty.	Remarks
Feeler gage	Comm. Avail.	1	None
Oil dipstick	Make from metal wire.	1	See Fig. 201.
Polyolester Oil	Comm. Avail.	A/R	Viscosity Grade 68
Anti-Seize Compound	MIL-A-907	A/R	None

3. COMPRESSOR MAINTENANCE PROCEDURES (REF. IPL Fig. 1)

   A. Compressor Drive Belt Removal, Installation and Adjustment.
      1. Loosen the two compressor pivot bolts (15). Loosen nut (29) and nut (17) securing the adjusting support.
      2. Remove the FWD short shaft assembly from between the free-wheeling output shaft and adapter pulley (12).
      3. Loosen the four bolts (24) securing the compressor mount (4) to pallet, remove the two forward bolts and slide compressor (2) forward.
      4. Remove old belt and install new belt (13).
      5. Slide compressor mount (4) aft and align the adapter (12) and clutch (2) pulleys. Replace the two forward bolts (24).
      6. Tighten bolts (24) securing compressor mount.
      7. Tighten nut (29) to tension belt. To tension belt:
         a. Adjust nut for moderate belt tension,
         b. Rotate tail rotor drive shaft through 2 revolutions.
         c. Tension belt to deflect 0.08 inch with a 2.4 – 3.2 lb. Force applied at midspan location.
         d. Rotate belt 2 revolutions, retention as required to obtain proper deflection.

8. Tighten nut (17) securing the adjusting support.
9. Install FWD short shaft assembly per installation procedure (Ref. Page 205). torque attach bolts to 70 in-lbs.
10. Re-tension belt after operating helicopter for 5 to 10 hours.

B. Clutch Air Gap Check

1. Measure clutch air gap with feeler gauge.
2. Clutch air gap should be 0.016 – 0.031 in. (0.4 – 0.8 mm).
3. If gap is not even around clutch, remove compressor from rotorcraft and gently pry up on the faceplate on low spots or tap down on high spots.
4. If overall gap is out of specification, remove compressor from rotorcraft and remove faceplate and change shims until gap is within specification. Air gap is controlled by the shims.

C. Compressor Oil Level Check

NOTE: It is not necessary to check the compressor oil level during routine maintenance or when a new compressor is installed. It only needs to be checked when incorrect oil level is suspected. (Example: ruptured line, blown compressor shaft seal, failed receiver dryer blow out plug where you have evidence of large quantities of oil discharged from the system)

1. Operate air conditioning system for 10 minutes. This will collect as much oil as possible in the compressor.
2. Discharge air conditioning system and remove compressor from rotorcraft.
3. Place compressor on table such that the oil fill plug is up.
4. Remove oil fill plug.
5. Insert dipstick into oil fill port.
6. Check that the oil level is 5 fluid ounces (at the 5th increment). Add or subtract oil in 1 fluid ounce increments until 5 fluid ounces is obtained.
7. Clean oil fill port area and install oil fill plug. Torque plug to 6 – 9 ft-lbs.

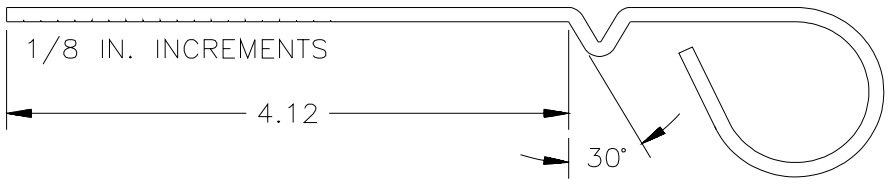

Figure 201. Make dipstick as shown above.

D. Compressor Pulley Installation.

1. Install the MS28775-211 o-ring (6) on the fwd. end of the oil cooler fan shaft assy by coating the o-ring with anti-seize compound per MIL-A-907 and sliding over the splines into the recessed area on the aft side of the splines.

2. Coat the inside of the JBS15005-2 (12) pulley between the threads and the counter bore with anti-seize compound. Also, coat the matching of the shaft with anti-seize compound.

3. Install the JBS15005-2 pulley (12) on the oil cooler fan shaft. Install wrench 206-1435-3 on Bell Thomas Coupling, P/N 206-040-328-3 splined adapter, using existing hardware. Using spanner wrench (Snap-On P/N APS363 or equal), hold pulley in place. Slide Thomas Coupling with wrench installed, over shaft and torque to 200 to 300 in/lb. Place wrench, P/N 206-1435-3, with rotorcraft's tools.

4. Install JBS15005-1 splined internal ring (10) over the shaft and align holes to match holes of pulley. Position the ring until holes align. Pulley may be adjusted slightly to achieve alignment, maintaining 200 to 300 in – lbs. torque.

5. Install (4) NAS1351-3H6 (25) screws in the JBS15005-1 ring and torque 50 to 70 in – lbs. Safety wire the four screws with MS20995C32, Single Wire Method in accordance with MS33540.

E. Disc Pack, Shaft Adapter or FWD Shaft Installation (Ref. Fig. 202)

1. On a bench, assemble the Bell adapter, P/N 206-040-328-3, to the disc pack P/N 32721-1 with existing Bell bolt, P/N AN174-7A and existing AN960-416L washer (under bolt head) installed in the adapter. Position disc pack on the bolts with one existing 206-040-329 washer per bolt between the disc pack and adapter.

NOTE: The radius of the washer must be mated against the disc pack. See Fig 202.

2. After the disc pack is in place, add (1) existing 206-040-329 washer on each bolt under the existing Bell nut, with the radius edge facing the disc pack. Insure that the bolts are installed as described with the bolt head on the adapter side of the assembly, then torque nuts per manufacturers specifications.

3. Slide the assembled disc pack and adapter onto the oil cooler fan shaft, Bell P/N 206-040-320-103.

4. Attach the forward shaft assy, P/N 206-040-325, to the disc pack/adapter assy. near the pulley with existing hardware oriented and installed as shown in Fig. 202. Insure that radius edge of washers mate against disc pack.

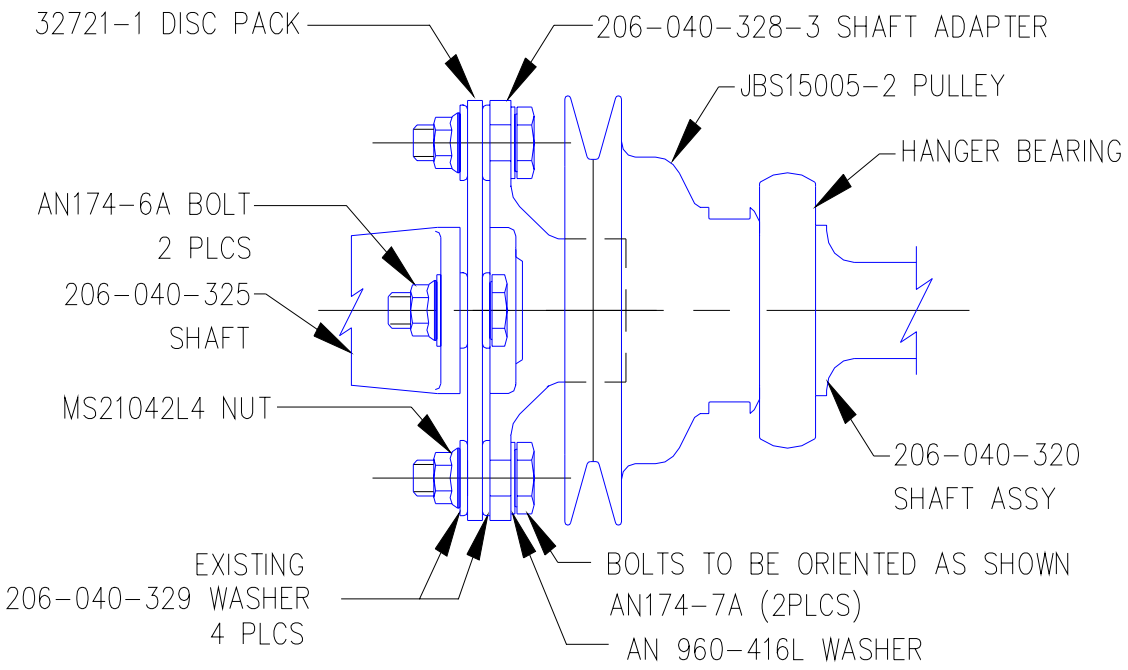

Figure 202. Pulley/Disc Pack Installation

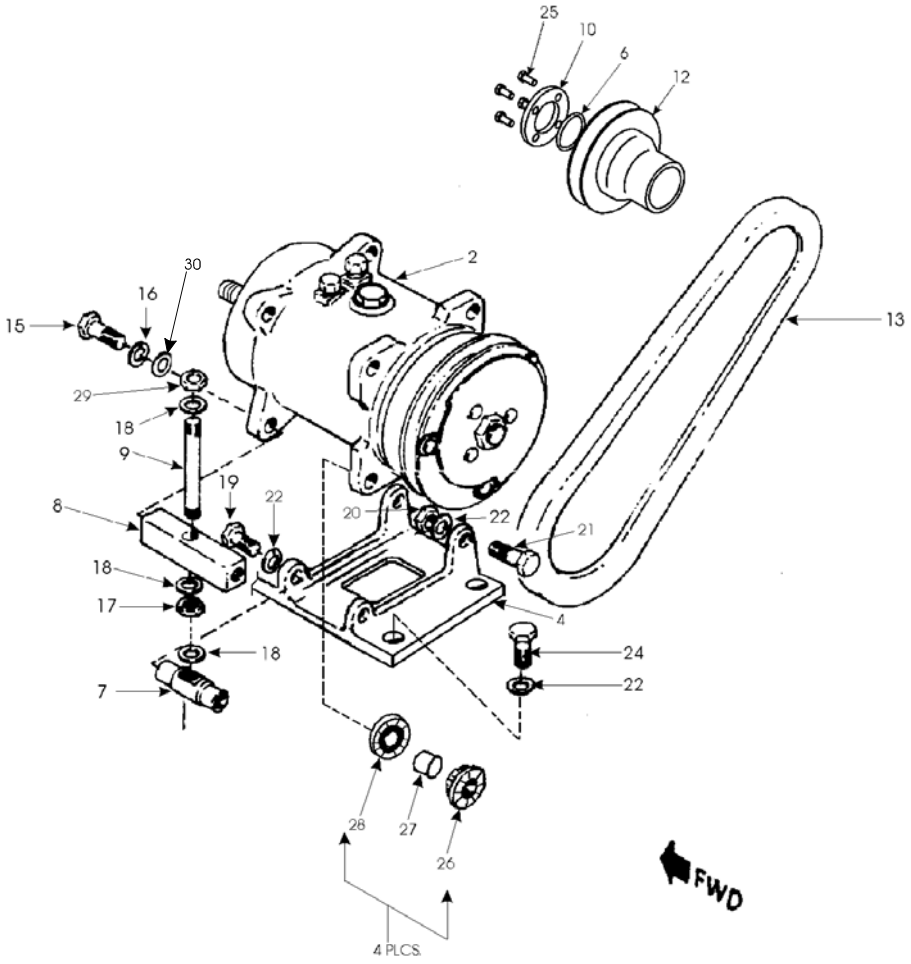

Figure 1
Compressor Assembly/Instl
Sheet 1 of 2

FIG. ITEM	PART NUMBER	NOMENCLATURE	EFFECT	UNITS PER ASSY
1 1	206-0408-1	Compressor Installation		RF
2	JBS220-1	Compressor Assy		1
4	JBS823-1	Compressor Mount		1
6	MS28775-211	O-ring		1
7	JBS806-5	Adj. Support		1
8	JBS806-4	Adj. Bracket		1
9	JBS59-7	Stud		1
10	JBS15005-1	Spline Interal Ring		1
12	JBS15005-2	Adapter Pulley		1
13	ES20033-27	Belt		1
15	AN4-13A	Bolt		2
16	AN935-416	Lock Washer		2
17	AN315-5R	Nut		1
18	AN960-516	Washer		3
19	AN4-6A	Bolt		2
20	MS21042-4	Nut		2
21	AN4-15A	Bolt		2
22	AN960-416	Washer		8
24	AN4-11A	Bolt		4
25	NAS1351-3H6	Screw		4
26	JBS364-2	Bushing		4
27	JBS197-6	Spacer		4
28	ES32066-2	Bushing		4
29	MS21042-5	Nut		1
30	214-1410-1	Washer		8
-	206-1435-3	Spanner Wrench		1

IPL Figure 1
Air Conditioning System-Compressor Assembly/Instl
Sheet 2 of 2

CONDENSER ASSEMBLY

DESCRIPTION AND OPERATION

1. GENERAL

The condenser assembly is located above the baggage compartment. It consists of a condenser coil unit, shroud, fan and receiver/drier. The condenser condenses the refrigerant gas to a liquid. The fan draws cool (ambient) air through the condenser coil. The condenser then removes heat from the refrigerant gas and turns it into a liquid. This liquid is collected by the receiver/dryer where moister is removed. The air is then exhausted overboard through a duct located on the bottom of the rotorcraft.

This section of the maintenance manual discusses troubleshooting and maintenance practices used for the condenser assembly portion of the air conditioning system. An Illustrated Parts List is included in Figure 1.

TROUBLESHOOTING

1. GENERAL

   The following procedures are used for troubleshooting the condenser assembly portion of the air conditioning system.

   For troubleshooting of the condenser fan, an electrical procedure is conducted per 21-50-01, page 101.

2. TOOLS AND EQUIPMENT

Designation	Ref. No.	Qty.	Remarks
Service Pressure Gauge	Comm. Avail.	1	None
28vdc Source		A/R	None

3. CONDENSER TROUBLESHOOTING PROCEDURES (REF. IPL Fig. 1)

   NOTE: Always attach a service gauge set to system prior to trouble shooting to insure proper refrigerant charge is present.

Trouble	Probable Cause	Correction
1. Low air flow across condenser coil.	Dirty condenser coil.	Clean condenser coil.

MAINTENANCE PRACTICES

1. GENERAL

   The following procedures are used to perform typical maintenance on the condenser assembly.

2. TOOLS AND EQUIPMENT

Designation	Ref. No.	Qty.	Remarks
Polyolester Oil	Comm. Avail.	A/R	Viscosity Grade 68
Vacuum Cleaner	Comm. Avail.	1	None
Coil Cleaner	Comm. Avail.	A/R	Non-acid based

3. CONDENSER ASSEMBLY MAINTENANCE PROCEDURES (REF. IPL Fig. 1)

   A. Condenser Coil Cleaning Procedure
      1. Use vacuum cleaner to remove large debris from upstream and downstream coil faces.
      2. Spray coil cleaner on both coil faces. Wash off with water.
      3. Allow coil to dry thoroughly prior to additional maintenance.

   B. Condenser Fan Overhaul
      The condenser fan can be overhauled with the replacement of the brushes and bearings. These items plus instructions to overhaul the fan are included in the overhaul kit (item 6).

   C. Rotorcraft Washing
      CAUTION: Cover the condenser inlet and exhaust openings on the side of the rotorcraft with appropriate covers to prevent water from entering inside of rotorcraft and damaging equipment.

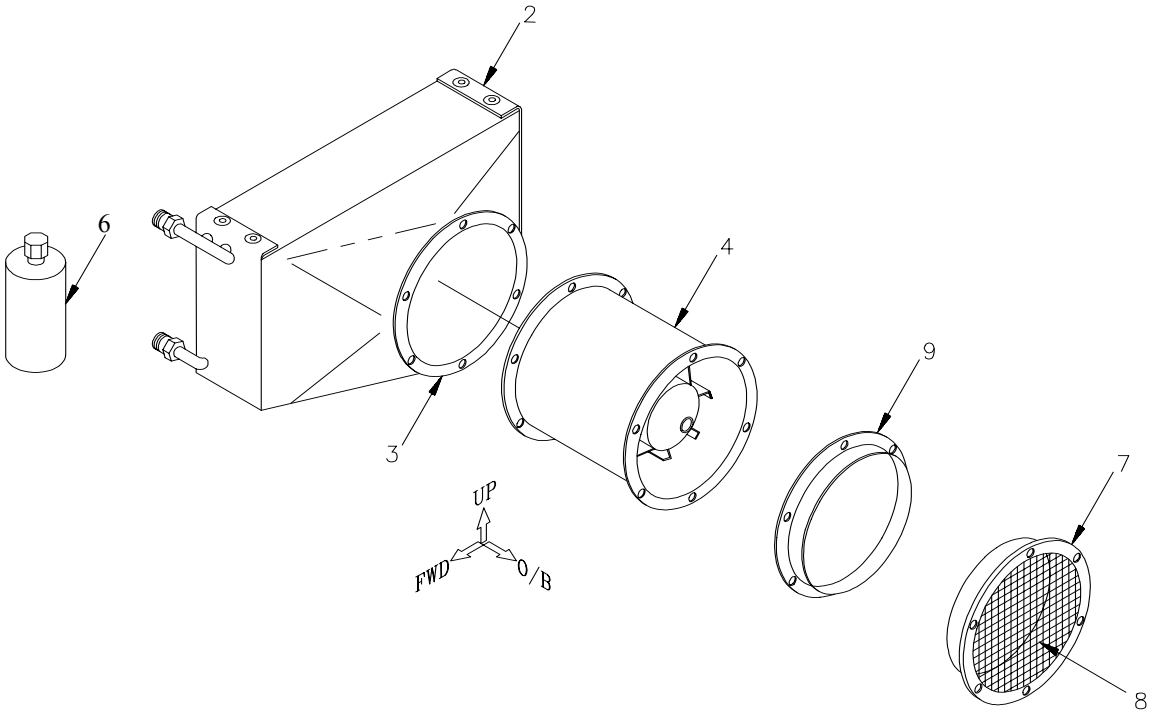

Figure 1.
Condenser Assembly
Sheet 1 of 2

FIG.	ITEM	PART NUMBER	NOMENCLATURE	EFFECT	UNITS PER ASSY
1	1	206-0302-6	Condenser Installation		RF
	2	206-1351-2	Coil Assy		1
	3	206-1362-1	Shroud		1
	4	ES73127-2	Fan, Vaneaxial		1
	5	ES73127-20	Fan Overhaul Kit		1
	6	ES43030-2	Receiver/Drier		1
	7	206-0358-2	Adapter Collar		1
	8	206-1329-1	Screen		1
	9	JBS333-5	Collar		1
					1

IPL FIGURE 1
Air Conditioning System – Condenser Assembly
Sheet 2 of 2

FWD EVAPORATOR ASSEMBLY

DESCRIPTION AND OPERATION

1. GENERAL

The FWD evaporator assembly for the TH-67 is located under the instrument panel on the right hand side with an air outlet on each side of the instrument panel. The evaporator assembly includes and evaporator coil, blower with motor, expansion valve and air outlet ducting.

This section of the maintenance manual discusses troubleshooting and maintenance practices used for the evaporator assembly portion of the air conditioning system. Additional troubleshooting and testing procedures for the evaporator blower is contained in 21-50-01, pages 101 and 501. An Illustrated Parts List is included in Figure 1.

TROUBLESHOOTING

1. GENERAL

   The following procedures are used for troubleshooting the fwd evaporator assembly portion of the air conditioning system.

2. TOOLS AND EQUIPMENT

Designation	Ref. No.	Qty.	Remarks
Service Pressure Gauge	Comm. Avail.	1	None
28vdc Source		A/R	None

3. EVAPORATOR TROUBLESHOOTING PROCEDURES (REF. IPL Fig. 1)

   NOTE: Always attach a service gauge set to system prior to troubleshooting to insure proper refrigerant charge is present.

   A. Water is Being Blown from Air Outlets.
      1. Start operate engine and apply 28 vdc electrical power.
      2. Select air conditioning system to ON
      3. Check evaporator drain for condensate runoff.
      4. If no runoff, clear drain of blockage or verify that routing is in a downhill orientation.
      5. Select air conditioning OFF, remove electrical power.

   B. No Cooling at Evaporator
      1. Connect service pressure gauge to service ports located near compressor in engine compartment.
      2. Start operate engine and apply 28 vdc electrical power.
      3. Select air conditioning system to ON.
      4. Check evaporator for proper cooling. If cooling not sufficient, check refrigerant level to ensure that system is correctly charged, this can be confirmed by a clear sight glass (no bubbles) on the top of the receiver dryer. If bubbles are present, add refrigerant till sight glass just clears.
      5. If system is correctly charged, replace expansion valve per Maintenance Practices procedure.

MAINTENANCE PRACTICES

1. GENERAL

   The following procedures are used to perform typical maintenance on the evaporator assembly.

2. TOOLS AND EQUIPMENT

Designation	Ref. No.	Qty.	Remarks
Sealant	ES49000-1	A/R	None
Polyolester Oil	Comm. Avail.	A/R	Viscosity Grade 68
Vacuum Cleaner	Comm. Avail.	1	None
Coil Cleaner	Comm. Avail.	A/R	Non-acid based

3. EVAPORATOR MAINTENANCE PROCEDURES (REF. IPL Fig. 1)

   A. Expansion Valve Replacement
      1. Discharge system in accordance with recovery equipments instructions.
      2. Disconnect liquid line from inlet of expansion valve, and cap. Remove the thermal sense bulb from its clamp located on the suction tube of the evaporator and carefully remove insulation covering bulb.
      3. Disconnect the fitting that connects the valve to the coil and plug coil fitting.
      4. Install new expansion valve and o-ring in the reverse order.
      5. Lubricate o-ring with polyolester oil or apply sealant to fitting mating surfaces prior to assembly.
      6. Install the thermal sense bulb such that it makes contact with the suction tube along its entire length. Insulate the bulb thoroughly with insulation.

   B. Evaporator Coil Cleaning Procedure
      1. Use vacuum cleaner to remove large debris from upstream and downstream coil faces.
      2. Spray coil cleaner on both coil faces. Wash off with water.
      3. Allow coil to dry thoroughly prior to additional maintenance.

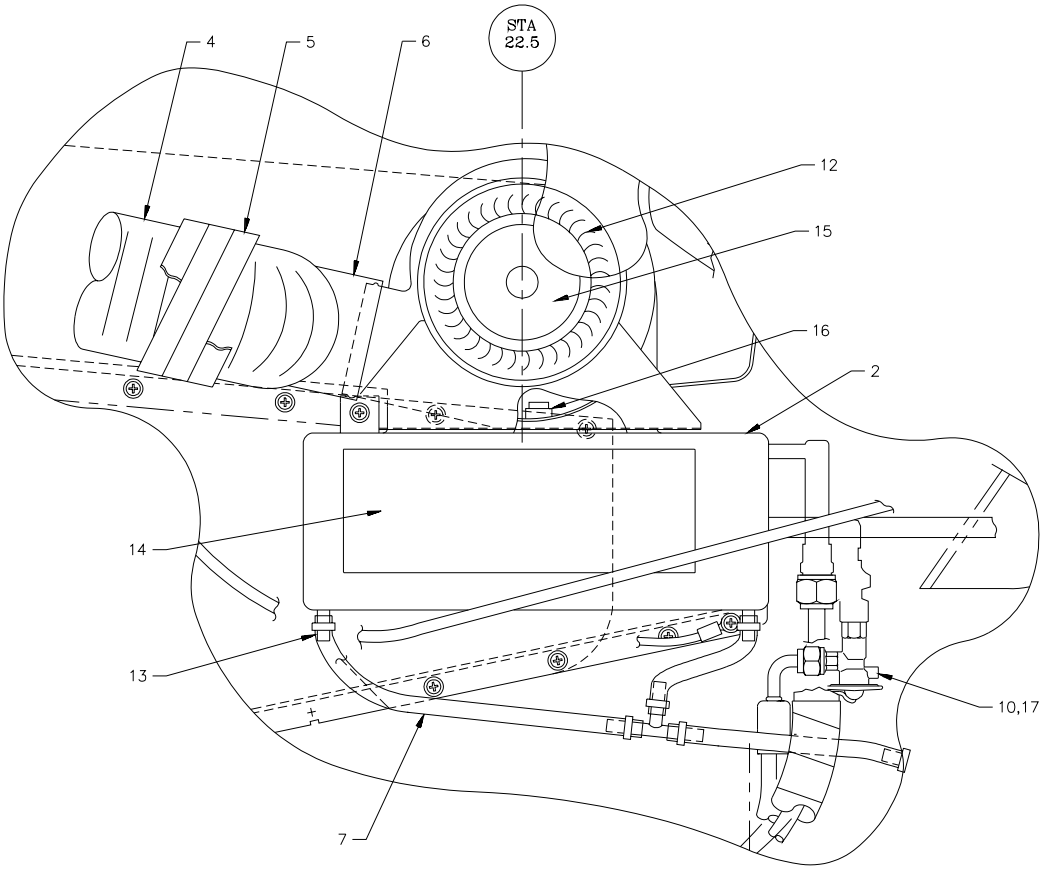

Figure 1
FWD Evaporator Assembly TH-67
Sheet 1 of 2

FIG. ITEM	PART NUMBER	NOMENCLATURE	EFFECT	UNITS PER ASSY
1 1	206-0207-1	FWD Evaporator Installation		RF
2	JBS2003-4	Evaporator Assy		1
10	ES26104-1	Expansion Valve		1
11	JBS862-4	Blower Housing		1
16	JBS240-2	Low Speed Resistor		1
12	ES73088-9	Blower Wheel		1
13	ES49006-1	Drain		1
14	JBS157-2	Coil Assy		1
15	ES61060-2	Motor Assy		1
17	ES49011-2	O-ring		1
4	ES70009-3	Flex duct		1
5	ES06022-1	Insulation Tape		360 in
6	JBS8011-1	Duct Assy		1
7	ES48012-2	Drain Tube		48 in

IPL FIGURE 1
Air Conditioning System-FWD Evaporator TH-67
Sheet 2 of 2

AFT EVAPORATOR ASSEMBLY

DESCRIPTION AND OPERATION

1. GENERAL

The aft evaporator assembly is located above the baggage compartment area and behind the rear passenger's seat. It consists of an evaporator, expansion valve, blower assembly and ducting. The blower supplies conditioned air to the cabin. The evaporator coil cools and dehumidifies the air to be distributed by the blower and ducting.

This section of the maintenance manual discusses troubleshooting used for the aft evaporator assembly portion of the air conditioning system. An Illustrated Parts List is included in Figures 1 and 2.

TROUBLESHOOTING

1. GENERAL

   The following procedure is used for troubleshooting the aft evaporator assembly. For additional troubleshooting procedures involving the electrical aspects of the evaporator blower, see 21-50-01, page 101.

2. TOOLS

Designation	Ref. No.	Qty.	Remarks
Service Pressure Gauge	Comm. Avail.	1	None
28vdc Source		A/R	None

3. EVAPORATOR TROUBLESHOOTING PROCEDURE (Ref. IPL, fig. 1 and 2)

   A. Water is Being Blown from Air Outlets
      1. Start operate engine and apply 28 vdc electrical power.
      2. Select air conditioning system to ON.
      3. Check evaporator drain for condensate runoff.
      4. If no runoff, clear drain of blockage or verify that routing is in a down hill orientation.
      5. Select air conditioning OFF, remove electrical power.

   B. No Cooling at Evaporator
      1. Connect service pressure gauge to service ports located near compressor in engine compartment.
      2. Start operate engine and apply 28 vdc electrical power.
      3. Select air conditioning system to ON.
      4. Check evaporator for proper cooling. If cooling not sufficient, check refrigerant level to ensure that system is correctly charged. This can be confirmed by a clear sight glass (no bubbles) on the top of the receiver dryer. If bubbles are present, add refrigerant till sight glass just clears.
      5. If system is correctly charged, replace expansion valve per Maintenance Practices procedure.

MAINTENANCE PRACTICES

1. GENERAL

   The following procedures are used to perform typical maintenance on the aft evaporator assembly.

2. TOOLS AND EQUIPMENT

Designation	Ref. No.	Qty.	Remarks
Sealant	ES49000-1	A/R	None
Polyolester Oil	Comm. Avail.	A/R	Viscosity Grade 68
Vacuum Cleaner	Comm. Avail.	1	None
Coil cleaner	Comm. Avail.	A/R	Non-acid based

3. EVAPORATOR MAINTENANCE PROCEDURES (REF. IPL Fig. 1)

   A. Expansion Valve Replacement
      1. Discharge system in accordance with recovery equipment instructions.
      2. Disconnect liquid line from inlet of expansion valve and cap. Remove the thermal sense bulb from its clamp located on the suction tube of the evaporator and carefully remove insulation covering bulb.
      3. Disconnect the fitting that connects the valve to the coil and plug coil fitting.
      4. Install new expansion valve and o-ring in the reverse order.
      5. Lubricate o-ring with polyolester oil or apply sealant to fitting mating surfaces prior to assembly.
      6. Install the thermal sense bulb such that it makes contact with the suction tube along its entire length. Insulate the bulb thoroughly with insulation.

   B. Evaporator Coil Cleaning Procedure
      1. Use vacuum cleaner to remove large debris from upstream and downstream coil faces.
      2. Spray coil cleaner on both coil faces. Wash off with water.
      3. Allow coil to dry thoroughly prior to additional maintenance.

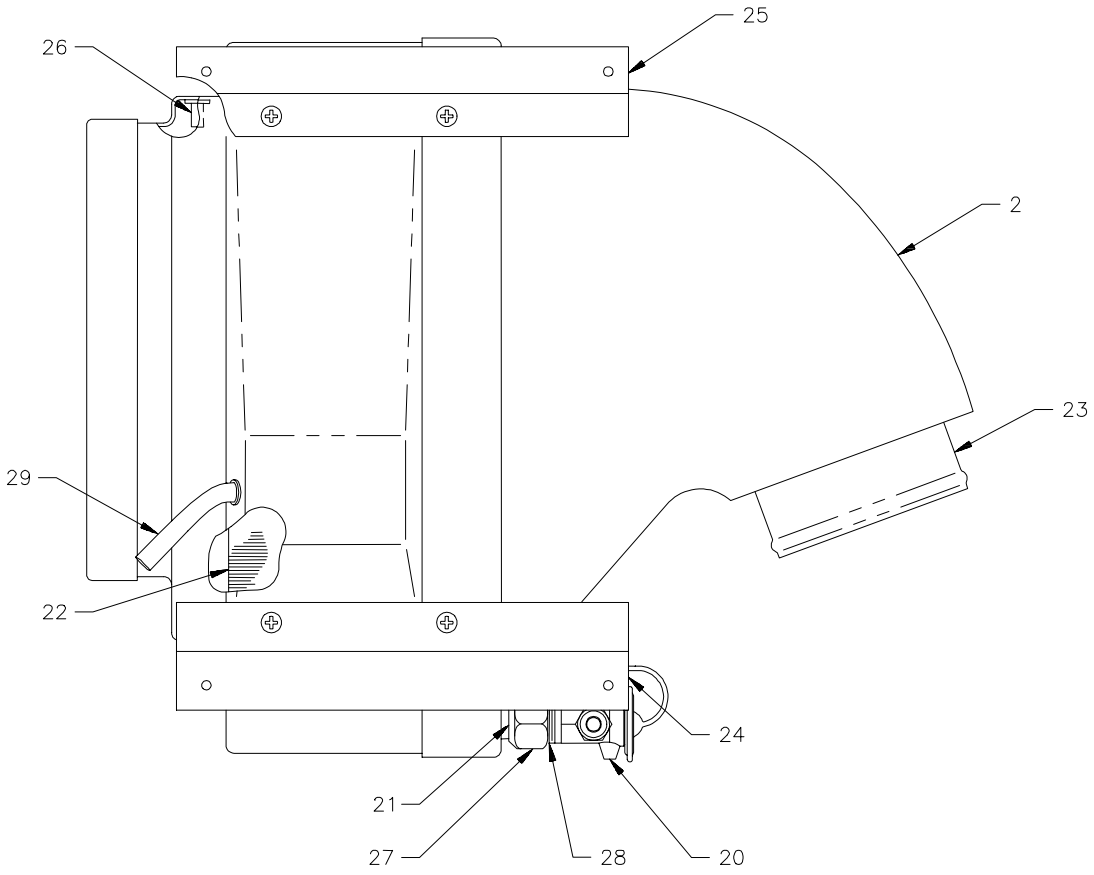

Figure 1
Aft. Evaporator Assembly
Sheet 1 of 4

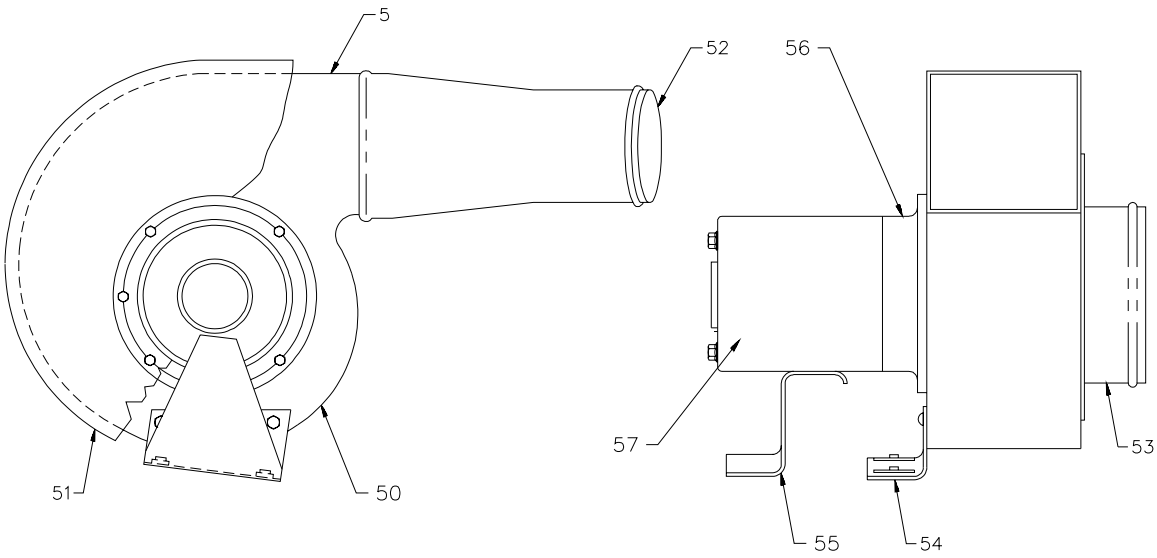

Figure 2
Aft Evaporator Assembly
Sheet 2 of 4

FIG. ITEM	PART NUMBER	NOMENCLATURE	EFFECT	UNITS PER ASSY
1 1	206-0209-1	AFT Evaporator Installation		RF
2	JBS2005-2	Evaporator Assy		1
20	ES26104-1	Expansion Valve		1
21	JBS60-2	Thermostat (Freeze sw)		1
22	JBS2006-2	Coil		1
23	JBS2007-1	Rear Cover		1
24	JBS2008-2	Bracket		1
25	JBS2008-2	Bracket		1
26	ES52126-1	Temp Sensor Probe		2
27	ES49011-2	O-ring		1
28	ES02163-2	Insulation		36 sq in
29	ES4812-1	Drain Tube		96 in

IPL FIGURE 1
Air Conditioning System-AFT Evaporator Assembly
Sheet 3 of 4

FIG. ITEM	PART NUMBER	NOMENCLATURE	EFFECT	UNITS PER ASSY
2 1	206-0202-5	Blower Instl.		1
5	JBS13002-1	Blower Assy		1
50	ES73103-6	Blower Housing		1
51	JBS363-1	Insulation		1
52	206-1259-1	Collar Adapter “Y”		1
53	206-0257-2	Collar Assy		1
54	JBS13012-3	Bracket Assy		1
55	JBS13012-2	Bracket Assy		1
56	JBS13012-1	Adapter		1
57	JBS27-7	Motor Assy		1

IPL FIGURE 2
Air Conditioning System-AFT Evaporator Blower Assembly
Sheet 4 of 4

CHARGING AND TROUBLESHOOTING

BACKGROUND

(This section will deal with troubleshooting the refrigeration circuit only.)

Assume that an aircraft is reported to have a malfunctioning system. The report from the pilots will usually say “poor cooling.” From this you must decide where to start your investigation. *(If the OAT is below 70°F it is more difficult to troubleshoot because of lack of heat load)*

BACKGROUND:

It needs to be understood that a vapor cycle refrigeration system is dynamic in nature. It is difficult to give exact temperature drops or suction pressure and discharge pressure for troubleshooting purposes with out knowing all the possible variables. It is recommended that you read and become familiar with this section before attempting to troubleshoot the air conditioning system. Below you will find a few examples of the dynamic nature of a refrigeration system that should help you in your troubleshooting process.

MEASURING TEMPERATURE DROP ACROSS THE EVAPORATOR:

Trying to associate a specific temperature drop across the evaporator is also dependent on many factors such as inlet air temperature, moisture content (relative humidity) and airflow. On a day with extreme humidity, up to 70% of the evaporator capacity will go towards dehumidification (latent Heat). That only leaves 30% available to actually lower the air temperature (sensible Heat). A mechanic when encountering this scenario may assume that because he can only measure a 10 deg. F drop in temperature that the system is not operating properly. This assumption is incorrect because he is not considering the amount of work it takes to condense moisture in the air and convert it to water that pours out of the condensate drain. To further complicate the issue if you eliminate the source of this humidity by closing the doors, your initial temperature readings will have a smaller temperature drop than measurements taken later. This is because you are drying out the air in the cabin and the evaporator is allowed to remove more sensible heat.

MEASURING SUCTION AND DISCHARGE PRESSURES:

The most accurate method to start diagnosing the system is to start with checking the pressures. However you must remember that these pressures are affected by many different conditions such as outside air temperature, cabin temperature, cabin humidity

and charge level. It is impossible to give an accurate head pressure at a specific temperature without knowing these other factors. These pressures can even vary during the troubleshooting process. As the system continues to run you are removing heat from the cabin and lowering the cabin temperature. This lowered heat load will result in lower suction and discharge pressures.

CHARGING EQUIPMENT

There are many different manufactures of charging equipment available on the market. They range in price and capabilities. EPA regulations require you to recover all refrigerant and not allow any to be vented to the atmosphere. Some machines only recover while others recover and recycle the refrigerant. It is recommended that only new or recycled refrigerant be used in the system. This will ensure that your system will not be contaminated with impure refrigerant.

SYSTEM DIAGNOSIS

It is important to understand the basic principals of vapor cycle air-conditioning before attempting to troubleshoot the system. The following is a brief overview.

Compressor: The compressor's only function is to raise the pressure of the refrigerant to a point where it can be condensed to a liquid at ambient temperature. Unfortunately as the laws of physics tell us, we create heat in the process of compression. We now have a superheated high-pressure vapor.

Condenser: The condenser's function is to remove the heat from the super heated vapor. As the heat is removed this gas will begin to condense into a liquid. Condensing occurs in accordance to a temperature / pressure ratio. *i.e. the higher the condenser air inlet temperature, the greater pressure required to condense. The inverse is also true, the lower the condenser air inlet temperature, the lower the pressure required for condensing.* This is why on a hot day you will have higher discharge pressures than on a cool day.

Receiver dryer: The receiver dryer is a reservoir for liquid refrigerant. It also contains a filter screen and a desiccant material to remove particles and moisture from the refrigerant. It ensures that a solid column of liquid refrigerant that has been filtered and dried is sent to the expansion valve.

Expansion Valve: The expansion valve is a device that meters liquid refrigerant into the inlet of the evaporator where it will be evaporated. It has an orifice with a metering pin to vary the flow of refrigerant. This pin is attached to a diaphragm that balances suction and spring pressure on one side and capillary sense bulb pressure on the other, which moves the pin in and out of the orifice.

The capillary sensing bulb contains a charge of refrigerant that is permanently sealed; this charge exerts pressure on the diaphragm to move the metering pin. The pressure is generated from expansion or contraction of its gas charge as the bulb is warmed or cooled.

This bulb attaches to the suction line where the refrigerant exits the evaporator. It measures the temperature of this line. If there is insufficient refrigerant flowing through the evaporator, the gas will be warmer than desired (superheat). This in turn will warm the sense bulb expanding the gas within and exerting pressure on the diaphragm moving the metering pin, increasing the flow of refrigerant to the evaporator. With the increased flow of refrigerant the gas temperature exiting the evaporator will be reduced. The sense bulb pressure will then lower, reducing the pressure exerted on the diaphragm moving the metering pin to reduce the flow. The valve will make adjustments until a balance has been reached. *One of the most common problems*

associated with expansion valves is a bad attachment of the sense bulb. It must make contact along its entire length and be securely attached to the metallic suction tube exiting the evaporator case. It must be thoroughly insulated with foam tape to ensure that outside air does not affect its reading.

Troubleshooting

Step One, Obvious Faults

(Engine Off) Verify that the evaporator inlet/outlets are not blocked. Verify that the condenser inlet/outlet is not blocked. Verify that both evaporator fans and the condenser fan function properly. With the air conditioning switch ON (the condenser fan should automatically turn on), verify compressor clutch engagement. Rotating the tail rotor and observing the compressor pulley and clutch plate for rotation will verify proper clutch engagement. Both the compressor pulley and clutch should rotate together with proper clutch engagement. Proceed to section 21-50-01 Electrical Troubleshooting if one/all of the fans does not operate properly. If the compressor clutch only does not engage, continue to STEP TWO.

Step Two, System Refrigerant Charge Verification

(STEP 2.1) Connect the system recovery/charge cart to the suction/discharge service tees. Purge the charging cart oil separator and dump oil collection bottle.

(STEP 2.2), Recover the refrigerant from the system in accordance the recovery cart's instructions. To ensure a complete removal of refrigerant, after initial recovery let the system sit for approximately 5-10 minutes to let any residual refrigerant boil from the system oil. Recover the residual refrigerant and note the total amount of refrigerant recovered. A normally charged system should contain 2.85 lb of R134a. If the system was undercharged this is a likely cause for poor / no cooling. After recharging, a thorough system leak-check with a 134a compatible leak detector, or "*sniffer*", should be performed until a leak is detected.

(STEP 2.3) After complete recovery of the refrigerant the system must be evacuated for 15 minuets to remove any trace of air and moisture. This can be done by selecting the evacuation mode on the charge cart. While the cart is in the evacuation process it will also be performing a recycling process on the removed refrigerant. This process removes moisture and contaminates and separates any oil from the refrigerant that was removed from the system during recovery.

(STEP 2.4) When the evacuation process is complete close both valves on the charge cart. Open the oil drain valve and note the quantity of oil removed. This is the amount of oil that will need to be added to the system before charging.

(STEP 2.5) Add the amount of new viscosity grade ISO 68 polyolester oil to the high side of the system by opening the discharge valve on the charge cart (suction valve closed) and slowly opening the oil charge bottle valve while noting the

quantity of oil being drawn into the system. (Add only the amount of oil recovered in step 2.4)

(STEP 2.6) Select the charging mode on the charge cart. Enter in the amount of refrigerant (2.85 lb) and select enter. Add refrigerant to the system high side only to push the added oil throughout the system. (Note: Adding oil or liquid refrigerant to the low side can cause a hydraulic lock in the compressor, damaging it upon start up.)

Step Three, System Pressures and Evaporator Temperature Drop

With the charge/recovery cart or a gauge set to the suction/discharge service tees, position the cart to a safe location away from engine exhaust and rotor. Ensure that engine exhaust and rotor wash will not move the cart from its established location during operation. After a successful engine start to idle RPM, turn the air conditioning system on. Set evaporator blower speeds to maximum and ensure that all air outlets are opened. After approximately 5-10 minutes of air conditioning operation, observe the system pressures. A normal pressure reading for the suction side should be between 20 and 40 PSIG (remember this is dependent on OAT and evaporator heat load). The discharge pressure should be between 200 and 300 PSIG (also dependent on OAT and evaporator heat load). Under high ambient temperatures, (120°F) the discharge pressure can reach up to 360 PSIG.

Measure the temperature of the air entering the FWD. evaporator as close to the coil as possible. Measure the temperature of the air exiting the evaporator in the outlet. This will give you a delta or differential temperature across the evaporator. Repeat for the aft evap. *This measurement needs to be preformed with a hand held digital thermometer after 5 minuets of system running for stabilization. The doors should not be opened between measurements of the fwd. and aft. differential temperatures* .

Both evaporators should have differential temperatures some where between 18 °F and 30°F depending on humidity.

Condition:

Higher Than Normal Head Pressure: Assuming that the system has been correctly serviced with 2.85 lbs and that the condenser fan operates as intended, the condenser face must be inspected for signs of dirt, debris or bent fins. If dented tubes (restricting more than 10%) are detected, the condenser should be removed and sent for repair. The condenser fan must first be removed before the condenser can be pivoted for inspection. Bent fins can be straightened with a condenser coil comb. If airflow is diminished by dirt or debris the condenser coils can be externally rinsed with a soap and water mixture. *If the condenser is*

removed for cleaning extreme caution should be taken as not to introduce moisture into the condenser plumbing.

Let us assume we know that our condenser blower and evaporator blowers are functioning properly. This leaves only those components that are involved in compressing and metering the refrigerant to be suspect of. The suction and discharge pressures will indicate the nature of the problem.

As stated above the expansion valve is the brains of the system. It decides how much liquid refrigerant to meter into the evaporator coil. When this component fails it is important to understand the different ways it can fail and the associated symptoms.

The valve is stuck in the mid range: This is usually associated with a contaminated system. Evaporator will have poor temperature drop at the extreme operating parameters. Inadequate refrigerant flow at high heat loads and excessive refrigerant flow at low heat loads (coil flooding)

The valve is stuck wide open: This will cause excessive refrigerant to flow into the evaporator coil. The coil will become “Flooded “ with liquid refrigerant. The result will be poor temperature drop because the refrigerant is not evaporating into a vapor. Because the expansion valve is wide open the suction pressure will be higher than normal and the return line will be very cold because the liquid refrigerant is evaporating in the line instead of the evaporator. The discharge pressure will be lower than normal because there is very little pressure drop across an open expansion valve. There may also be bubbles in the sight glass under this condition.

The valve is stuck closed: This will result in minimal refrigerant flow in to the evaporator. The coil is being starved for refrigerant. The result will be poor temperature drop due to the lack of refrigerant available to evaporate. The suction line exiting the evaporator will be warmer than normal. The suction and discharge pressures in this scenario will not look too much different than normal. The biggest clue will be a very warm suction line at the compressor.

(It is very important to understand that in a two-evaporator system it is more difficult to determine which valve is malfunctioning. If one valve is stuck wide open it will consume all of the refrigerant (path of least resistance) and give you the indication of the other valve starving.

The suction pressure is too high: This is caused by excessive refrigerant flow into the evaporator coil. The coil will then become flooded with liquid refrigerant. The result will be poor temperature drop because the refrigerant is not evaporating into a vapor. Because the expansion valve is wide open the suction pressure will

be higher than normal and the return line will be very cold because the liquid refrigerant is evaporating in the line instead of the evaporator. The discharge pressure will be lower than normal because there is very little pressure drop across an open expansion valve. There may also be bubbles in the sight glass under this condition.

To determine which expansion valve is defective you will need to feel each evaporator suction tube where it exits the evaporator housing. The evaporator that has the coldest tube and the lowest evaporator differential air temp should be the defective valve.

The suction pressure is too low: This can be caused by diminished refrigerant flow. The result will be a poor temperature drop because insufficient refrigerant is flowing through the coil. This will cause the suction tube to be warmer because of the diminished flow; all of the refrigerant has evaporated into a vapor. The discharge pressure will be higher than normal because there is a large pressure drop across a closed expansion valve.