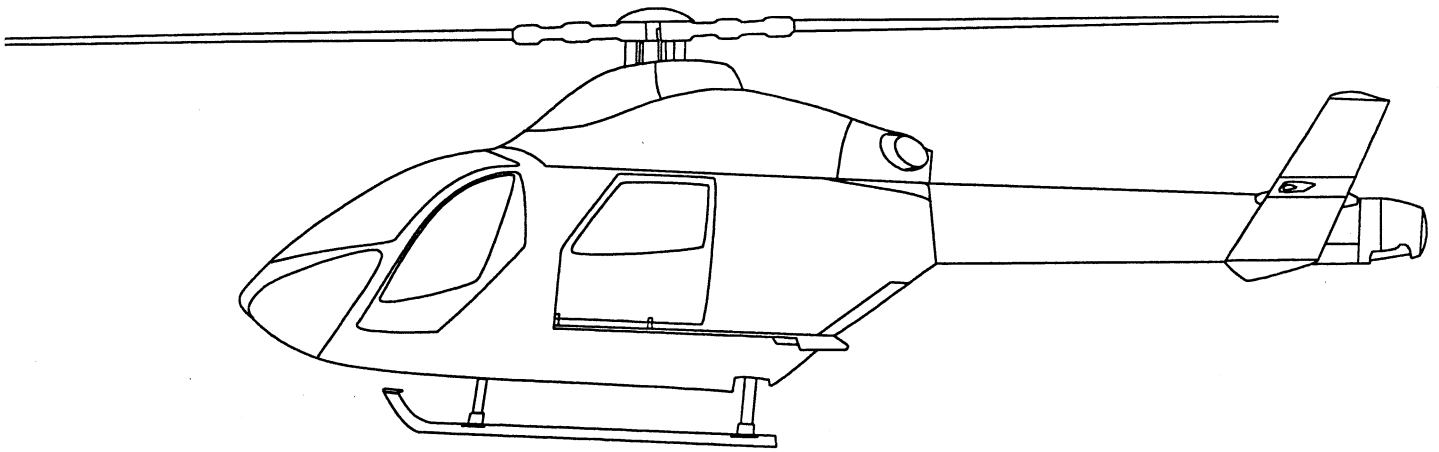
AIR COMM CORPORATION
Boulder Municipal Airport
3300 Airport Road
Boulder, CO 80301

Report MD900AC-200M



MAINTENANCE / SERVICE INSTRUCTIONS
McDONNELL DOUGLAS MD-900 AIR CONDITIONING SYSTEM

For System Installation
MD900AC-100

June 20, 1995

Air Comm, Corporation

Revisions Page

Rev	Page	Description	Date	Aprvd

MD900AC-200M **Air Conditioning System** **Maintenance / Service Instructions**		**Rev N/C**
	Sheet 1 of 1	

Table of Contents

Introduction

This document provides maintenance and service information for the MD900AC-100 Cabin Air Conditioning System installations in the McDonnell Douglas MD-900 Helicopter.

Appendix A provides the system installation parts listing for the air conditioning system.

Applicability

McDonnell Douglas MD-900 Helicopters.

SYSTEM DESCRIPTION

The vapor cycle system installation consists of two forward evaporators, one aft evaporator, a condenser, and a compressor which is belt driven by the right engine main rotor drive shaft. These components provide "conditioned air" through the existing air distribution system when the engines are operating during both ground and flight operations.

Component locations are shown in figure 1.

The system can be operated in either the **AC** or **VENT** mode.
In the **AC** mode, conditioned air is provided to the cockpit and cabin through the forward and aft evaporators. A five position rotary switch **AC/VENT** controls the vent fan and air-conditioning. **COOL HIGH** provides air-conditioning at a high setting. **COOL LOW** provides air-conditioning at a low setting, selected from the center console utility panel assembly. Air conditioning temperature may be controlled by an **AC TEMP CONTROL** switch located overhead on the windscreen center brace.

In the **VENT** mode the forward evaporator blowers are used to circulate cabin air. The aft evaporator blower draws fresh air through the fresh air inlet duct and existing water separator. The fresh air is then distributed to the cabin and cockpit through existing outlets. The blowers can be operated on either **VENT HI** or **VENT LOW** speeds. **VENT LOW** provides vent air at a low setting. **VENT HIGH** provides air at a high setting.
(See figure 2)

The cabin heater can be operated simultaneously with the AC to achieve desired cabin temperature, or to defog cabin windows.

MODEL MD-900 AIR CONDITIONER

SYSTEM DESCRIPTION (cont'd)

The compressor is mounted forward of the right engine and the drive pulley is bolted to the Right Main Rotor Transmission drive shaft adapter. Power is transmitted to the compressor by means of a 3/8" V-belt.

The air flow pumping action through the condenser heat exchanger is provided by two six inch diameter Jetfans. (ejectors). These units are powered by engine bleed air. The bleed air flow is controlled by a firewall mounted solenoid operated shutoff valve. The failure mode of the shutoff valve is closed.

The air conditioning electrical system is designed so that the system automatically "drops off line" in case of failure of either engine.

The original rotorcraft fresh air electrical system is modified to include the inlet door actuator, and both the forward and rear evaporator blowers. The fresh air inlet source is retained, while the original vent system fan is removed. The new aft evaporator blower replaces the function of the original vent fan. The fresh air inlet duct door is incorporated as part of the evaporator assembly. This door is operated by means of an electric actuator.

SYSTEM DESCRIPTION (cont'd)

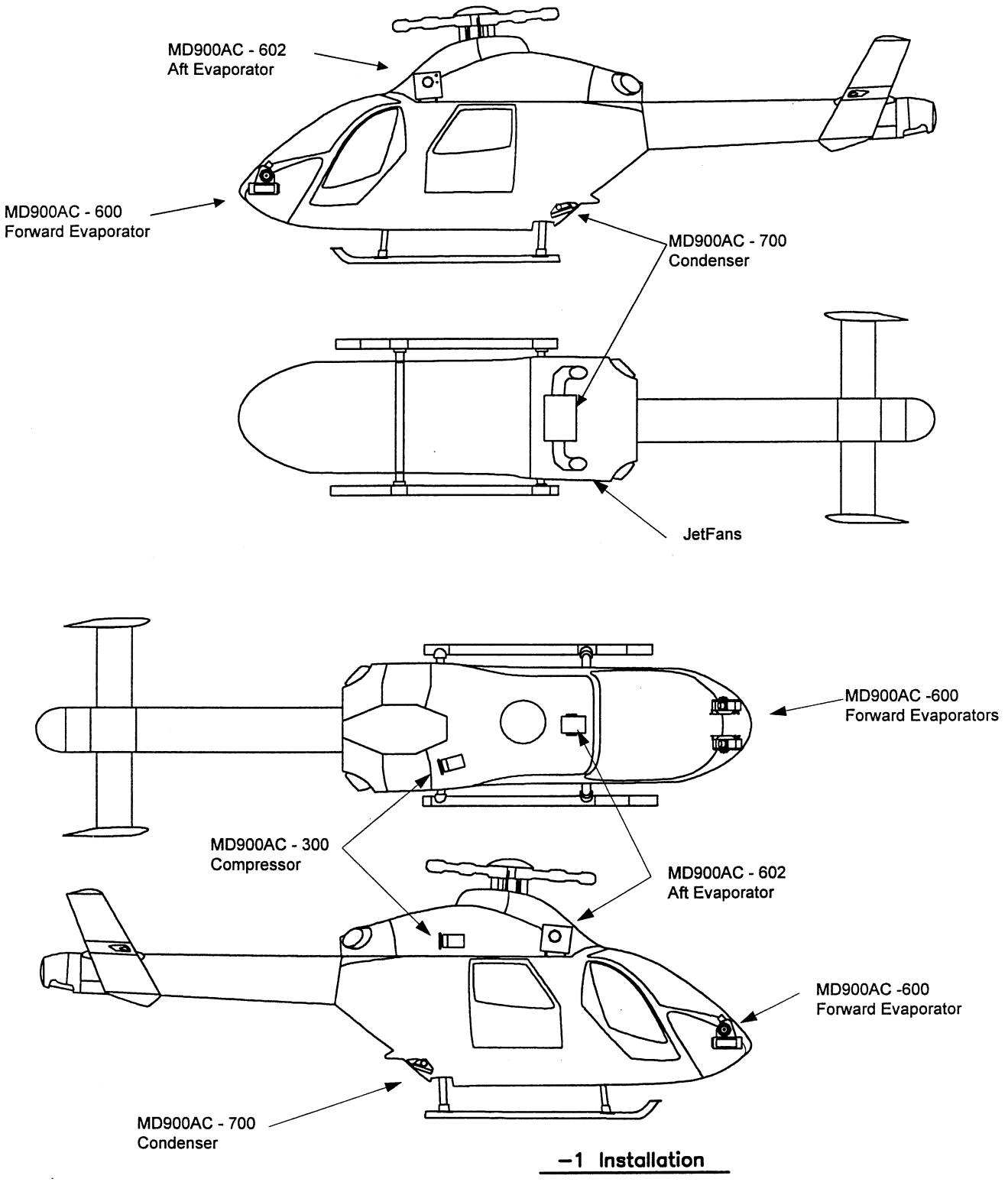
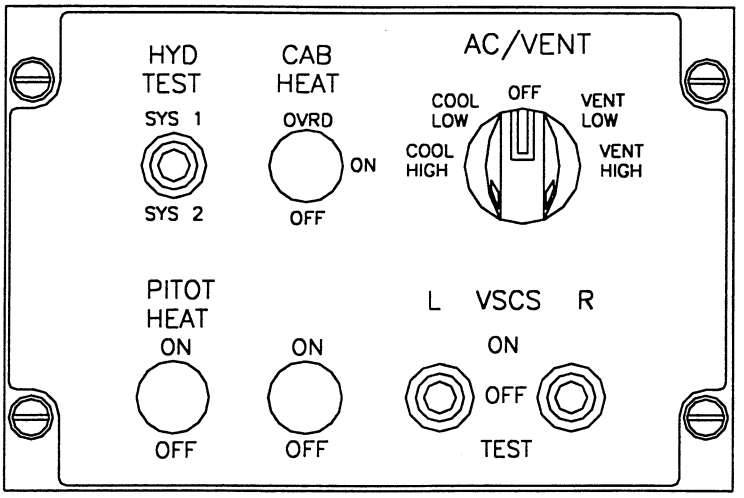


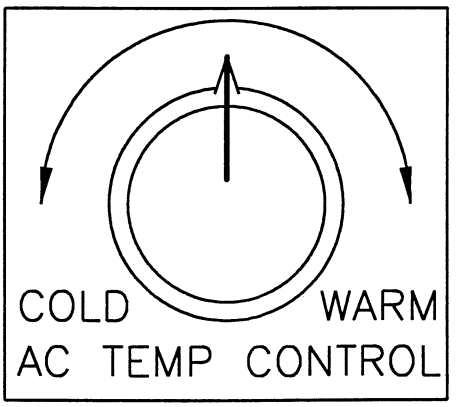
Figure 1. General Arrangement - MD900 Air Conditioning System

Figure 2. **AC/Vent Controls**



Located in the center console utility panel.

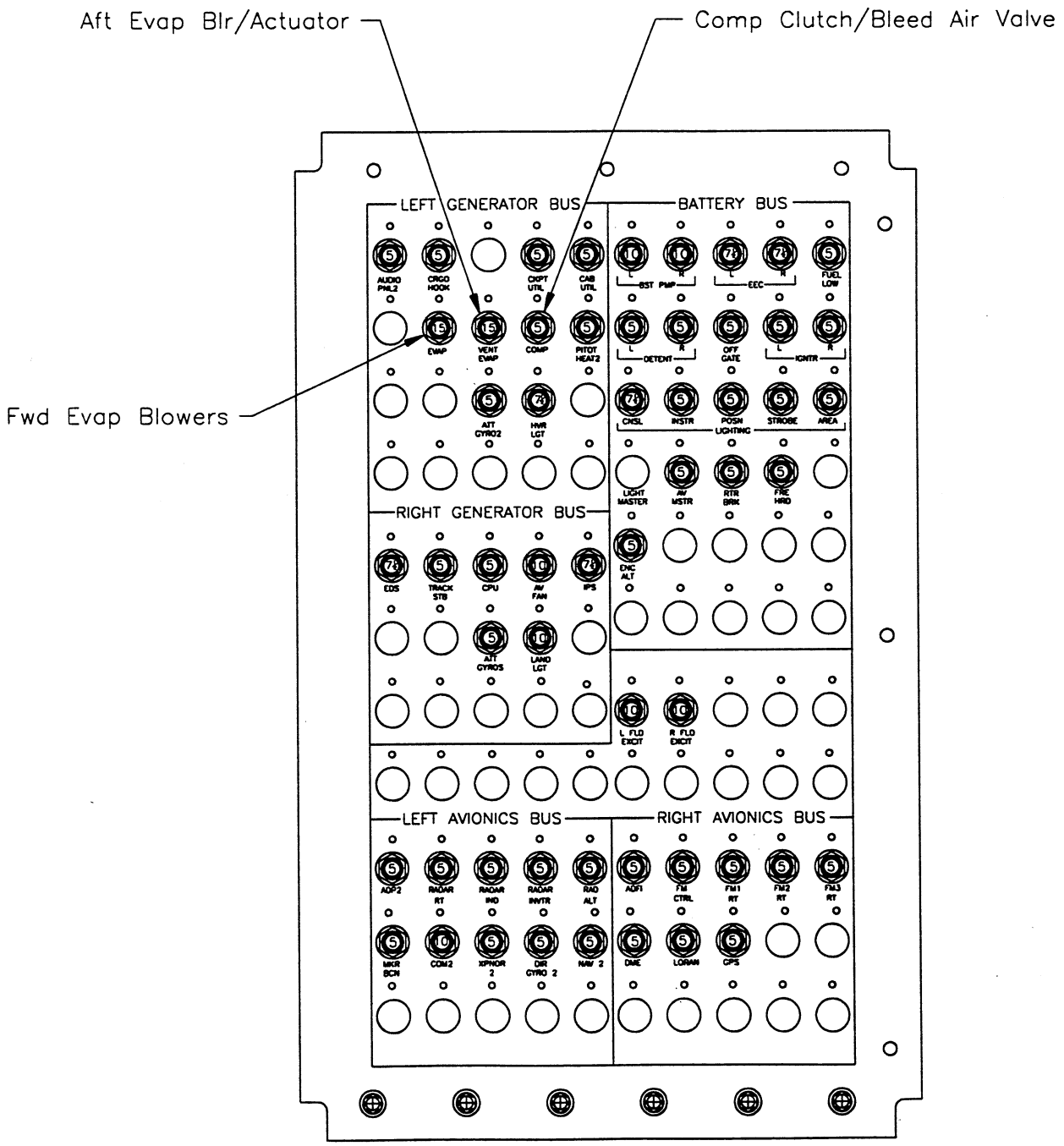
Figure 3. **AC/Temp Control**



Located on windscreen center brace.

SYSTEM DESCRIPTION (cont'd)

Figure 4 **Air Conditioner Circuit Breaker Panel**



Located in Center CB Panel.

System Protection Features (see Elect Schematic; Pg 24)

Pressure Switch

The system is equipped with a refrigerant system protection switch. This switch is designed to protect the system against system overpressure, loss of refrigerant, and operation during low ambient temperatures.

The switch operating pressures are:

Low Pressure Function:
Cutout at 30 psi
Cutin at 50 psi

Note
If the ambient temperature drops below 30°F, the system cannot be operated until the ambient temperature is at least 50°F.

High Pressure Function:
Cutout at 335 psi
Cutin at 280 psi

Bypass Valve

The system incorporates a refrigerant Bypass Valve. The purpose of this valve is to prevent freeze-up of the evaporator heat exchangers without cycling the compressor clutch. The valve limits the evaporator fin temperature to not less than 33° F. The Bypass Valve is also used in conjunction with the temperature control switch to adjust the conditioned air temperature in the cabin and cockpit. When a warmer temperature is selected, the temperature control switch opens the bypass valve and returns the refrigerant to the compressor instead of passing it through the forward and aft evaporators. The amount of refrigerant bypassed is controlled by the temperature control switch which senses the internal temperature of the aft evaporator and compares it to the selected temperature.

Suggested Spares List

Item	Description	Part No.
1	Blower Motor - Forward & Aft Evaporators	ES61060-2
2	Condenser Jetfan Bleed Air ON-OFF Valve	ES26185-1
3	Compressor Assembly	MD900AC-3540-1
4	Compressor Drive Belt	3VX300
5	Receiver - Drier Bottle	804-297
6	Pressure Switch	ES57008-1
7	Refrigerant Bypass Valve (Temp Control)	ES26112-2
8	Electrical Components - See Page 24.	

Source: **Air Comm Corporation**
Boulder, Colorado
(303) 440-4075 Phone
(303) 440-6355 FAX

SAFETY PRECAUTIONS

The refrigerant used in the air conditioning system is the environmentally safe **HFC R134a**. This refrigerant is non-explosive, non-flammable, non-corrosive, has practically no odor, and is heavier than air. Although R134a is classified as a safe refrigerant, certain precautions must be observed to protect parts involved and the person working on the unit.

Liquid R134a at normal atmospheric pressure and temperature evaporates so quickly that it tends to freeze anything that it contacts. **Care must be taken to prevent any liquid refrigerant from coming in contact with the skin, especially the eyes**.

CAUTION

Always wear safety goggles when servicing any part of the refrigerant system. Should any liquid refrigerant get into the eyes, flood the area with cool water, and **seek medical attention immediately**.

It is important to keep the system tightly sealed because the refrigerant system is always under pressure. Heat applied to any part would cause this pressure to build up excessively.

CAUTION

To avoid explosion, never weld, use a flame-type leak detector, blow torch, solder, steam clean, bake an aircraft finish, or use excess amounts of heat on, or in the immediate area of any part of the air conditioning system or refrigerant supply tank, while they are closed to atmosphere.

WARNING

Fire or explosion hazard exists under certain conditions with R-134a. A combustible mixture can form when air pressures are above atmospheric pressure, and a mixture of air and R-134a exist. For this reason do not pressure test air conditioning systems with compressed air.

Tools, Equipment and Consumables

Servicing of the MD900AC-100 Air Conditioning System requires the use of certain special tools which are normally found in most shops.

These tools are listed as follows:

1. Service Manifold with "high" and "low" side gauges which are compatible with R134a systems. This item is used to evacuate the system, to install refrigerant, and to read system pressure following system charging.

2. Charging Cylinder. This item should be equipped with an electrically powered heating element. This unit is used to "charge" the system with a measured amount of freon. The heating element raises the gas pressure so that it will flow into the system. This item is available at most automotive service centers.

3. Flushing Tank (optional). This item is required only if the system should become contaminated and thus require cleaning.

4. Electronic Leak Detector compatible with R134a.

5. Consumables:

   a. No. 6 "O" ring pkg. of 20 P/N 440-1840

   b. No. 8 "O" ring pkg. of 20 P/N 440-1841

   c. No. 10 "O" ring pkg. of 20 P/N 440-1842

   d. HFC R134a refrigerant

   e. Refrigerant oil: Polyester oil
      Emkarate RL100S or Eq.
      ICI America, Inc.
      Wilmington, DE

CAUTION - USE ONLY HSN O-RINGS

CAUTION - USE ICI POLYESTER OIL ONLY

Lubrication

The total system oil charge is 15.5 ounces.
Compressors are factory charged with 3.5 oz. of oil. An additional 12 oz. of oil should be added to the discharge line prior to system charging.

Care should be taken to avoid spilling any of the compressor oil charge during installation. If this should occur, drain the oil and recharge to 3.5 oz.

The oil charge is continuously circulated by the refrigerant.

If the system "charge" is reclaimed or if a sudden loss of "charge" occurs a significant amount of oil will be removed from the system. An attempt should be made to determine the amount of lost oil. Typically, the amount lost is about 4 ounces, and this amount should be added for each reclaim, or sudden loss of refrigerant.

WARNING

Inadequate oil in the system will result in compressor "lock-up" and require replacement of the compressor.

Receiver Drier

The receiver drier is the system reservoir and is located between the condenser and the expansion valve.

The drier bottle contains a XH9 desiccant filter (silica gel) which serves to absorb moisture from the system.

NOTE

To prelude saturation of the desiccant, the drier line caps should not be removed until just prior to evacuation and charging of the system. The drier bottle should be replaced whenever the system is discharged.

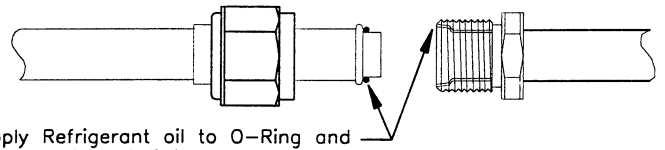
Refrigerant Fitting Assembly Instructions

The MD900AC-100 air conditioning system utilizes primarily O-Ring fittings. There are a limited number of 37° flare (AN). The type fitting at each joint is identified on pages 20 thru 23.

A light coat of refrigerant oil should be applied to all O-Rings and to the face of the flare fittings prior to assembly.

All flare fittings must be extremely tight.

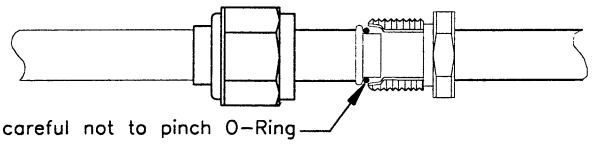
O-Ring fittings should be tightened sufficiently to slightly compress the O-ring (EXCESSIVE TORQUE WILL DAMAGE THE FITTING). See O-Ring installation instructions below.



Apply Refrigerant oil to O–Ring and Female side of fitting

Confirm there is no damage / nicks or dirt on fittings

Slide B–Nut back away from end of tube so you may see O–ring as you slide the fitting together.



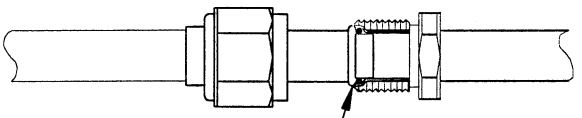
Be careful not to pinch O–Ring

Engage male end into female fitting being very careful to maintain alignment and not pinch O–ring during this step.

The male flange should seat fully against the metal side of the female flange without the O–ring being pinched between.

Hold fitting together while sliding B–Nut forward and engaging threads. tighten B–Nut and torque to the following settings

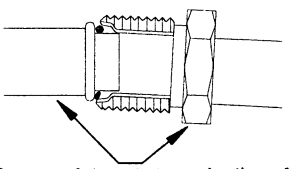
\# 6 Fittings: 30–35 in/lbs DO NOT OVER TORQUE
\# 8 Fittings: 40–45 in/lbs.
#10 Fittings: 50–55 in/lbs.



Female fitting should seat against metal of male fitting

Once system is Charged, check each fitting with an electronic leak detector. (an Electronic Leak Detector is the only reliable method of checking for refrigerant leaks)

Once fittings have been checked and are leak free, Torque Seal as appropriate.



Be careful not to misalign fittings as they are placed together.

System Leak Check

Identification and **elimination** of any system fitting leaks is **extremely important** to insure a trouble-free system.

A system which contains a partial charge can be leak tested and recharged without evacuating the system. The system can be pressurized with nitrogen or R134a refrigerant. A system which has been evacuated should be filled to a pressure of at least 50 psig of refrigerant or 150 psi nitrogen prior to the leak survey.

The system should be leak tested using a combination of a soap solution and an electronic leak detector. Initial leak check can be accomplished with a nitrogen pressure charge of approximately 150 psi and a soap solution. Each fitting should be checked and repaired prior to charging with refrigerant. **Do not use compressed air for the pressure check**. Compressed air can introduce moisture in the system which will cause it to operate poorly or not at all. Once the nitrogen check is complete, the system must be checked with a refrigerant charge. Use an electronic leak detector and check each connection in the system. Take your time and check all around each fitting. A little extra time during the leak check will save a significant amount of time later during servicing or troubleshooting.

All leak checks should be conducted with the air conditioner "off." Since the refrigerant is heavier than air, leaks are most likely detected on the underside of hoses and fittings. Also the refrigerant will collect in low areas and provide an erroneous leak indication. A stream of shop air through a nozzle is useful in clearing an area just before checking for leaks.

If a leak is detected at an "O" ring fitting, reclaim the system and install a new "O" ring. Lubricate the "O" ring with refrigerant oil prior to installation.

A small amount of leakage (one ounce per year) past the compressor shaft seal is normal. Most leak detectors are sensitive enough to show a leak of this magnitude.

CHARGING PROCEDURE

* Note -- System to be serviced by qualified personnel only.

1. Leak check system in accordance with procedures present on page 12.

2. Evacuate system for a minimum of 30 minutes.

3. Charge system with 7.2 lbs. of R134a refrigerant. System pressures should be **approximately** as shown below. The **most accurate** method of charging a system is to add refrigerant until evaporator outlet air temperature and system suction pressure reaches a **minimum** and subsequently start to increase. The optimum charge occurs when evaporator outlet air temperatures are at their lowest. Any additional refrigerant will cause the outlet air temperature to increase and system performance to be degraded. Charge system to the point of noticing first temperature increase, then reduce charge back to the optimum point where outlet air temperatures were lowest.

REFRIGERANT PRESSURE - TEMPERATURE CHART

The following data is provided as reference information. System pressures can vary from this table depending on Temperature / Humidity relationships.

Ambient Temp °F	High Pressure Gauge Reading	Suction Gage Reading
55	95-115	30 - 40
60	105-125	
65	115-135	
70	130-150	
75	150-170	
80	165-185	
85	175-195	
90	185-205	
95	210-225	
100	220-240	
105	240-260	30 - 40

Belt Replacement and Adjustment

Belt Replacement:

Remove safety wire and loosen the lock nuts on adjusting link and turn link to shorten. Rotate the compressor towards the drive pulley and remove the belt.

Belt Adjustment:

Over tightening the belt will shorten belt life and may damage compressor clutch bearings. Insufficient belt tension will result in belt slippage, excess heat, and reduced belt life. The correct tension is .12 inch deflection with 7 lbs. pull on the belt halfway between the two pulleys.

System Troubleshooting

Prior to troubleshooting a defective system, conduct a visual inspection for general condition. Inspect condenser fins for damage, comb out bent fins.

The following step-by-step procedure lists the easiest checks, and most likely problem sources, first.

1. **Electrical**

   With engine off turn switch to "Blower" and make sure all evaporator blowers work in VENT HI and VENT LO modes. Turn switch to A/C. Check that the JetFan bleed air valve opens and that the compressor clutch is engaged.

   Function and electrical continuity of circuit breakers, relays, and blower motors should be checked. Also, the compressor clutch coil and HI and LO pressure switches should be checked. The function and operation of the system pressure switch should be reviewed (Pg 8).

2. **System Charge**

   Connect service manifold to service tees and purge the air from the manifold lines. The static pressure should read approx. 70 psi. If the pressure is 60 psi. or less, the system has a leak. If the pressure reads 70 psi. or more, it could still be low on refrigerant and should be checked with the compressor running. Start aircraft and run at 100% NR with air conditioner on. The system pressures should correspond to the table on page 16.

3. **Expansion Valve Malfunction**

   If the cooling loss is limited to only one evaporator, it is most likely a defective expansion valve.
   Loss of cooling in all evaporators could be caused by freon flow blockage at the expansion valves. This blockage could be due to ice or dirt.

   For a suspected defective expansion valve, contact ACC.

   If the system appears to be contaminated, it should be flushed.

   If ice blockage of the expansion valve is suspected, the system should be evacuated and recharged using a new receiver-drier bottle.

4. **Compressor Malfunction**

   If the system will not maintain the normal pressures and there are no system leaks, the problem could be a failed compressor. The compressor must then be replaced.

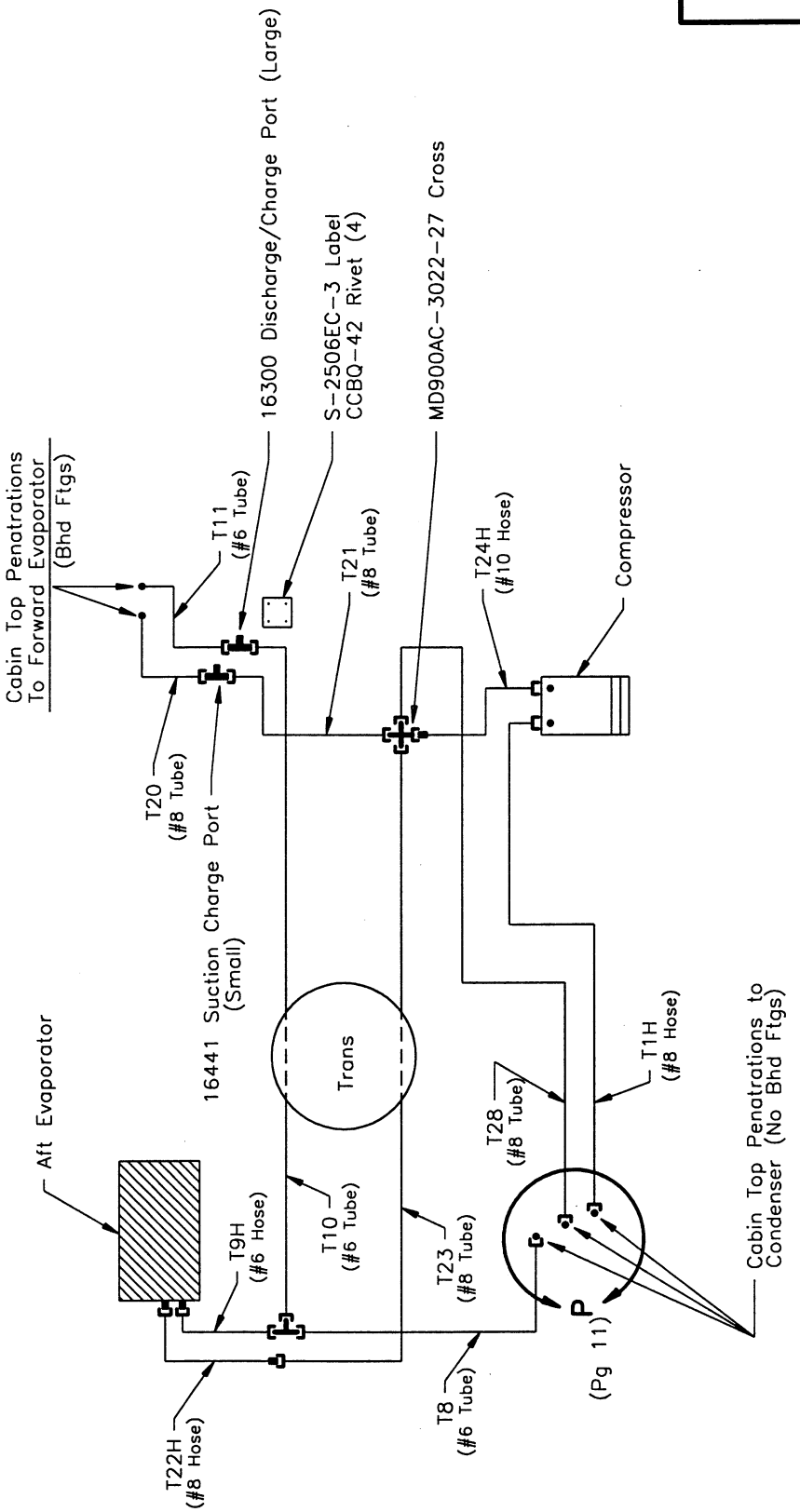
PERIODIC INSPECTIONS AND OVERHAUL SCHEDULE

Item	Prior to Cooling Season	Every 100 hr. Operation	Every 500 hr. Operation
Check Evap. Blower HI / LO	X		X
Check Cond. JetFan Operation	X		X
Belt Wear & Tension	X [1]		X [1]
Heat Exchanger Fins - clean	X		X
Placards	X		X
Compressor Mount for Cracks	X	X	X
Replace Belt			X [1]

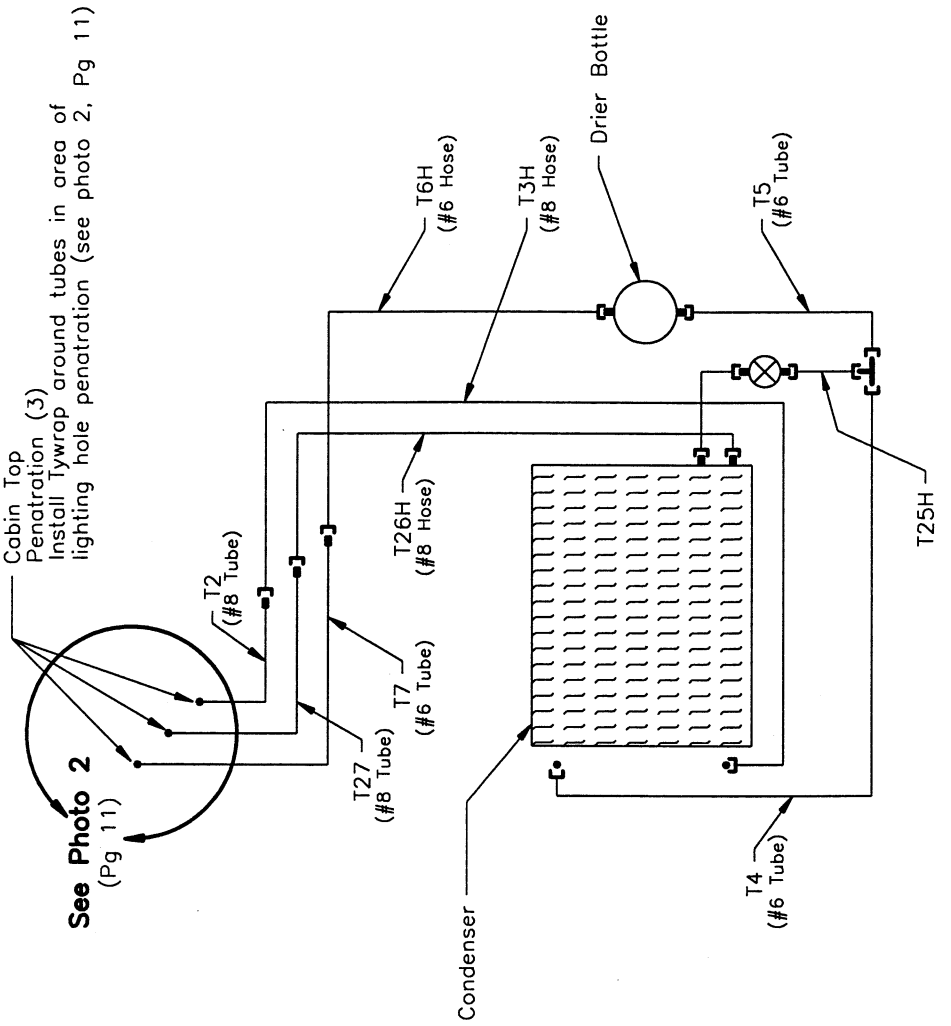
Notes:

[1]The belt tension on a newly installed belt should be reset after two hours of operation.

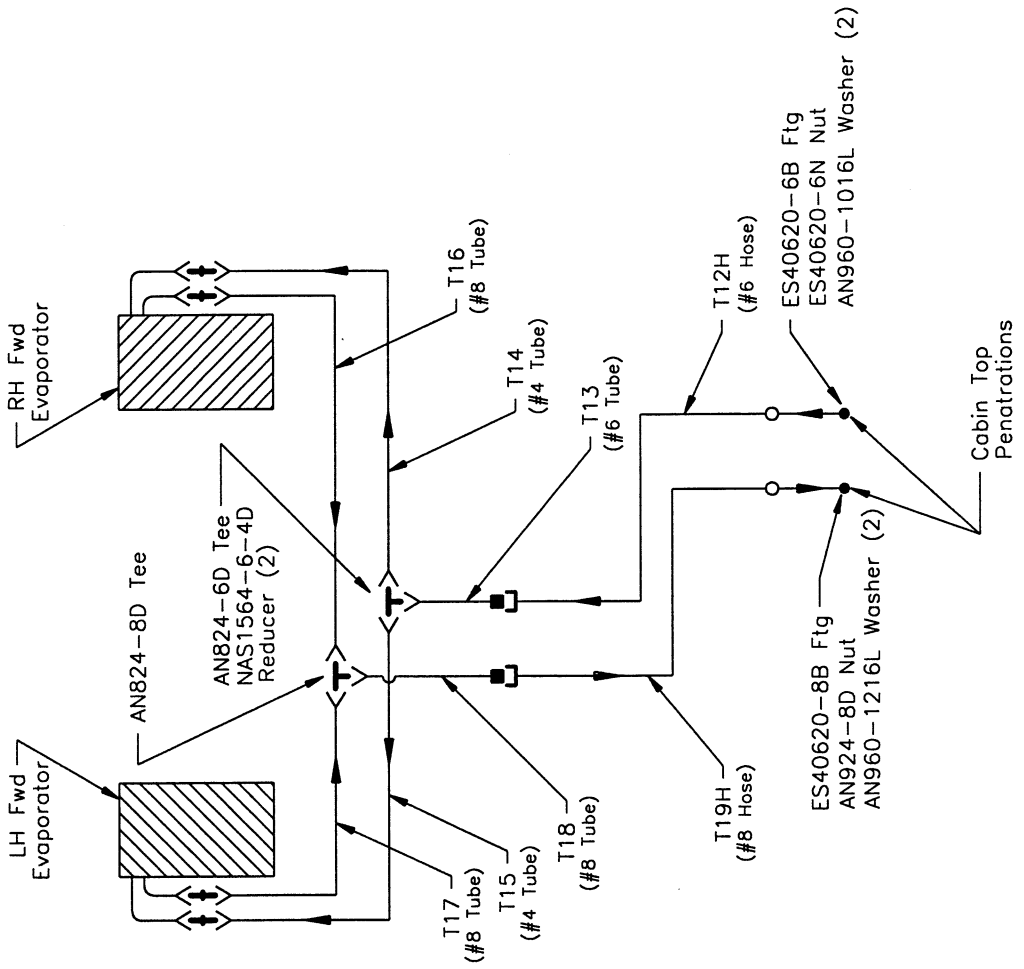
[2]It is acceptable to remove the compressor drive belt during the cold weather season. Care should be taken to insure that the compressor is securely supported by the belt tension link.



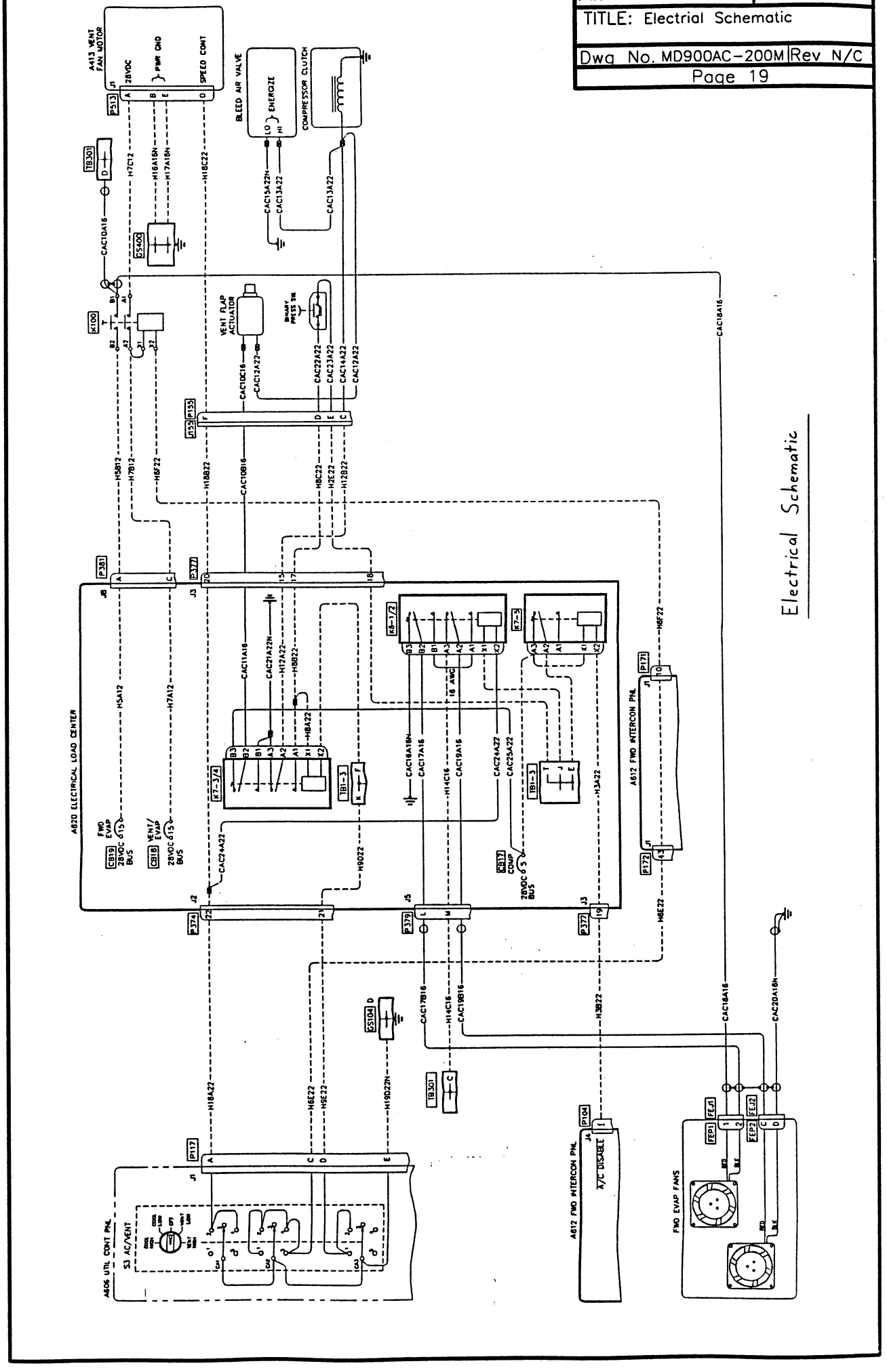
Plumbing Schematic–Cabin Top Area



Plumbing Schematic—Cabin Top to Condenser



Plumbing Schematic
Cabin Top to Forward Evaporator


A413 VENT FAN MOTOR
28VDC
PWR GND
SPEED CONT
BLEED AIR VALVE
ENERGIZE
COMPRESSOR CLUTCH
VENT FLAP ACTUATOR
BINARY PRESS SW
A620 ELECTRICAL LOAD CENTER
FWD EVAP 28VDC BUS
VENT/ EVAP 28VDC BUS
A612 FWD INTERCON PNL
A/C DISABLE
FWD EVAP FANS
A606 UTIL CONT PNL
S3 AC/VENT
Electrical Schematic

Appendix A

System Component Parts Listing

Rev	Date	Description	Appr

NOTES:

Item	P/N	Description	Qty/Instl -1
	-1	Installation - MD900	\
1	MD900AC-300-1	Compressor Installation	1
2	MD900AC-500-1	Plumbing Installation	1
3	MD900AC-520-1	Plumbing - Engine Bleed	1
4	MD900AC-600-1	Evaporator Installation - Fwd	1
5	MD900AC-602-1	Evaporator Installation - Aft	1
6	MD900AC-680-1	Air Distribution System	1
7	MD900AC-700-1	Condenser Installation	1
8	MD900AC-800-1	Electrical Installation	1

Drawn DKF
Date 03-26-95
Appr
Tol .X ± .1
.XX ± .03
.XXX ± .010
ANGLE ± 1 degree

TITLE General Arrangement - MD900 Air Conditioner	
Dwg No. MD900AC-100	Rev N/C
Sheet 1 of 3	

Rev	Date	Description	Appr

NOTES:

1 Torque all hardware in accordance with AC43-13.

2 Safety wire Belt Tension Link per AC43-13-A after installation.

3 Apply thin coat of Pro Seal 890 (or Eq.) between faying surfaces of MD900AC-3020-1 support and fuselage skin. (Pg 5)

4 Drive shaft installation / removal procedures: (Pg 9)

a. Slide MD900AC-3500-1 Pulley over Main Rotor Drive shaft.

b. Slide Drive shaft into position.

c. Slide pulley into position shown by View D-D.

d. Install coupling bolts.

5 Compressor installation procedure:

a. Position MD900AC-3022-10 & -11 Channels as shown on pages 5 & 8. Match drill all channel web holes.

b. Position MD900AC-3000-1 Mount Assy as shown on pages 5 & 7. Match drill MD900AC-3020-1Support thru cabin top skin and MD900AC-3022-10 & -11 Channels (17 Pls).

c. Remove channels & deburr. Rivet channels in position shown and install MD900AC-3020-1 Support.

d. Position Compressor/MD900AC-300-1 Mount Assy on MD900AC-3020-1 Support. Install belt and align compressor with MD900AC-3500-1 Drive Pulley.

e. Mark position of mount assy. Remove and match drill mount to support as shown on page 6.

f. Rivet bolt strips to MD900AC-3020-1 Support as shown on page 6.

g. Install support and compressor / mount assy. Adjust belt tension in accordance with system service manual.

Drawn D KF
Date 03-14-95
Appr _____
Tol .X ± .1
.XX ± .03
.XXX ± .010
ANGLE ± 1 degree

ACC AIR COMM CORPORATION
Boulder, CO 80301

TITLE: Installation-Compressor

Dwg No. MD900AC-300 | Rev N/C

Item	P/N	Description	Qty/Instl -1
	-1	Installation MD900AC	\
1	MD900AC-3000-1	Mount Assy	1
2	412AC-3012-1	Link Assy	1
3	MD900AC-3012-10	Sleeve	2
4	MD900AC-3012-11	Sleeve	2
5	MD900AC-3500-1	Drive Pully	1
6	MD900AC-3540-1	Compressor	1
7	MD900AC-3020-1	Support Assy-Compressor	1
8	MD900AC-3022-14	Bolt Strap	2
9	MD900AC-3022-15	Bolt Strap	2
10	3Vx315	Belt	1
11	AN6-13A	Bolt	2
12	AN6H-27A	Bolt	1
13	AN6H-47A	Bolt	1
14	NAS6204-6	Bolt	4
15	MS21042-L08	Nut	17
16	MS21042-L4	Nut	6
17	MS21042L6	Nut	4
18	AN960-416	Washer	6
19	AN960-616L	Washer	6
20	AN960-8L	Washer	17
21	MS24693-12	Screw	2
22	MS27039-815	Screw	15
23	MS20470AD4-8	Rivet	4
24	MS20470AD-4-5	Rivet	52
25	MD900AC-3022-10	Channel	1
26	MD900AC-3022-11	Channel	1
27	MD900AC-3030-1	Belt Guard	1
28	MD900AC-3030-2	Belt Guard	1

TITLE: Installation-Compressor

Dwg No. MD900AC-300 | Rev N/C

Rev	Date	Description	Appr

NOTES:

1. Charge system plumbing in accordance with S-2506EC-3 Label.

2. System to be charged with an additional 8 oz of Polyester refrigerant oil Emkarate RL100S (ref # 1593); ICI America, Inc.; Wilmington, DE (1-800-822-8215).

3. Apply light film of refrigerant oil to the face of flare fittings and to O-Rings. Apply No. 55441 Loctite Refrigerant sealant to the fitting threads prior to assembly.

   Note

   a. FLARE FITTINGS MUST BE TIGHT.

   b. O-RING FITTINGS TO BE SNUG AGAINST O-RING, AND THEN AN ADDITIONAL HALF TURN. EXCESSIVE TORQUE WILL DAMAGE THE FITTING.

4. Switch operating pressures: ON @ 50 psi
   cutout @ 335 psi
   cutout @ 30 psi

5. HSN O-Rings required (Highly Saturated Nitriles; green).

6. Keep "end caps" on Drier Bottle until just prior to system charge.

7. Clamp system plumbing in accordance with AC43.13-1A.

Drawn DKF
Date 05-08-95
Appr _____
Tol .X ± .1
.XX ± .03
.XXX ± .010
ANGLE ± 1 degree

ACC AIR COMM CORPORATION
Boulder, CO 80301

TITLE Installation - Plumbing

Dwg No. MD900AC-500 | Rev N/C

Item	P/N	Description	Qty\1
	-1	Installation	\
1	MD900AC-5022-T2	Tube Assy	1
2	MD900AC-5022-T4	Tube Assy	1
3	MD900AC-5022-T5	Tube Assy	1
4	MD900AC-5022-T7	Tube Assy	1
5	MD900AC-5022 -T8	Tube Assy	1
6	MD900AC-5022-T9	Tube Assy	1
7	MD900AC-5022-T10	Tube Assy	1
8	MD900AC-5022 -T11	Tube Assy	1
9	MD900AC-5020-T13	Tube Assy	1
10	MD900AC-5020-T14	Tube Assy	1
11	MD900AC-5020-T15	Tube Assy	1
12	MD900AC-5020-T16	Tube Assy	1
13	MD900AC-5020-T17	Tube Assy	1
14	MD900AC-5020-T18	Tube Assy	1
15	MD900AC-5022-T20	Tube Assy	1
16	MD900AC-5022-T21	Tube Assy	1
17	MD900AC-5026 -H1	Hose Assy	1
18	MD900AC-5026-H3	Hose Assy	1
19	MD900AC-5026-H6	Hose Assy	1
20	MD900AC-5026-H12	Hose Assy	1
21	MD900AC-5026-H19	Hose Assy	1
22	MD900AC-5026-H22	Hose Assy	1
23	MD900AC-5022-T23	Tube Assy	1
24	MD900AC-5026-H24	Hose Assy	1
25	MD900AC-5026-H25	Hose Assy	1
26	MD900AC-5026-H26	Hose Assy	1
27	MD900AC-5022-T27	Tube Assy	1
28	MD900AC-5022-T28	Tube Assy	1

TITLE Installation - Plumbing	
Dwg No. MD900AC-500	Rev N/C
Sheet 2 of 12	

Item	P/N	Description	Qty\1
29	MD900AC-5022-27	Cross	1
30	ES26101-5	Bypass Valve	1
31	S-2506EC-3	Label - Charging Instructions /1\	1
32	804-297	Receiver/Drier (AIR)	1
33	No. 6	O-Ring (AIR 440-840) /5\	30
34	No. 8	O-Ring (AIR 440-841) /5\	25
35	No. 10	O-Ring (AIR 440-842) /5\	6
36	MS21919DG-6	Clamp	8
37	MS21919DG-8	Clamp	8
38	MS21919DG-10	Clamp, Loop type, cushioned	5
39	MS21919DG40	Clamp	1
40	AN824-6D	Tee	1
41	AN824-8D	Tee	1
42	NAS1564-6-4D	Reducer	2
43	MS21266N-2B	Grommet (GM-1)	1
44	ES57008-1	Switch	1
45	ES40620-6N	Nut	1
46	AN924-8D	Nut	1
47	MS21042L3	Nut	15
48	AN525-10R6	Screw	11
49	AN960-10L	Washer	17
50	AN960-1016L	Washer	2
51	AN960-1216L	Washer	2
52	ES40620-6B	Fitting	1
53	ES40620-8B	Fitting	1
54	16441	Suction Port Ftg	1
55	16300	Discharge Port Ftg	1

TITLE Installation - Plumbing	
Dwg No. MD900AC-500	Rev N/C
Sheet 3 of 12	

Rev	Date	Description	Appr

NOTES:

1 See mast pattern for tube geometry.

2 Weld ES49015-10 Ftg. Existing fitting (MDHS P/N). TIG Wesl per MIL-W-8611.

3 Bond 3" x 5" doubler to bulkhead as shown (.053 Gillfab HDSTD-98006).

Drawn DKF
Appr ____
Date 03-09-95
Tol .X ± .1
.XX ± .03
.XXX ± .010
ANGLE ± 1 degree

TITLE Instl - Jetfan Bleed Air Plumbing	
Dwg No. MD900AC-520	Rev N/C
Sheet 1 of 5	

Rev	Date	Description	Appr

NOTES:

1 Cover duct with ES02165-26 sleeve.

2 Trim sleeve to required length.

Item	P/N	Description	Qty/Instl-1
	-1	Installation	\
1	-10	Duct (CAT 12)	75"
2	-11	Duct (CAT 12)	37"
3	-12	Duct (CAT 11)	32"
4	-13	Duct (CAT 11)	32"
5	-14	Duct (CAT 14)	8"
6	S-6078EC-8	Blower	1
7	S-6078EC-9	Blower	1
8	MD900AC-6000-1	Evaporator	1
9	MD900AC-6000-2	Evaporator	1
10	412AC-6024-10	Support	1
11	412AC-6024-11	Support	1
12	412AC-6024-14	Brace	2
13	AN42-100	Rivet	3
14	AN525-10R18	Screw	1
15	AN525-10R20	Screw	4
16	AN960-10L	Washer	9
17	MS21042L3	Nut	4
18	MS21059-L3	Nutplate	2
19	MS24693S278	Screw	1
20	NAS43DD3-40	Spacer	1
21	NAS43DD3-48	Spacer	1
22	NAS43DD3-55	Spacer	4
23	CT11B	Tywraps (Hiline or EQ)	8
24	CT28B	Tywraps (Hiline or EQ)	4
25	80-004-2-6	Insert	2

Drawn DKF
Date 03-13-95
Appr _____
Tol .X ± .1
.XX ± .03
.XXX ± .010
ANGLE ± 1 degree

TITLE Installation - Forward Evaporator

Dwg No. MD900AC-600 | Rev N/C

Rev	Date	Description	Appr

NOTES:

Item	P/N	Description	Instl-1
	-1	Evaporator	\
1	MD900AC-6002-1	Cabin Evaporator (Aft)	1
2	MD900AC-6003-1	Blower Motor Assy	1
3	MD900AC-6022-7	Duct Adapter	1
4	MD900AC-6004-1	Air Distribution Box	1
5	MD900AC-6022-4	Duct Adapter	1
6	MD900AC-6022-6	Duct Adapter	1
7	MD900AC-6022-42	Bracket	1
8	MD900AC-6003-10	Support	1
9	MD900AC-6022-45	Doubler	1
10	MS21059L08	Nutplate	1
11	MS21059L3	Nutplate	1
12	AN743-12	Clip	1
13	AN470AD-3	Rivet	2
14	CAT 11	Duct	36"
15	CAT 18	Duct	24"
16	MS21919DG6	Clamp	2
17	-10	Drain Tube	1
18	200-3052	Hose	1"

Drawn D KF
Date 03-14-95
Appr
Tol .X ± .1
.XX ± .03
.XXX ± .010
ANGLE ± 1 degree

ACC AIR COMM CORPORATION
Boulder, CO 80301

TITLE: Installation-Evaporator, (Aft)

Dwg No. MD900AC-602 | Rev N/C

Sheet 1 of 11

Rev	Date	Description	Appr

NOTES:

1. Replace existing SCAT 5 Duct by SCAT 7.

2. Rivet & Bond Adapter to Shroud using A42-100 Rivets & Proseal 890, respectively.

Item	P/N	Description	Instl-1
	-1	Installation	\
1	MD900AC-6022-8	Duct Adapter	2
2	MD900AC-6022-9	Duct Adpater	1
3	SCAT-7	Duct	72"
4	AN960-8L	Washer	2
5	MS21042L08	Nut	2
6	AN525-8R6	Screw	2
7	AN470AD-3	Rivet	5
8	CR3213-4-2	Rivet	4
9	A42-100	Rivet	10

Drawn D KF
Date 05-30-95
Appr _
Tol .X ± .1
.XX ± .03
.XXX ± .010
ANGLE ± 1 degree

ACC AIR COMM CORPORATION
Boulder, CO 80301

TITLE: Installation-Air Distrubition System

Dwg No. MD900AC-680 | Rev N/C

Sheet 1 of 5

Rev	Date	Description	Appr

NOTES:

1 Apply ProSeal 890 or EQ between faying surfaces of outer skin (7).

2 Edge Seal all cutout per MDHS Service Instructions (7).

3 Bond doublers around cutouts to inside & outside surfaces of skin panel (total 4 doublers). Bond doublers in position shown using Hysol EA9321 Adhesive. Trim outbd edge of doubler as shown. Doubler specifications as follows:

MANUFACTURE FROM HDSTD-98-6006
8 PLIES OF GILLFAB 1086-053003,
PREPREG CARBON FIBER
1 PLY OF 1680 PREPREG E-GLASS
WITH 724 FINISH
DOUBLER OD 10.00; ID 5.75; T = .050
ORIGINAL PANEL THICKNESS: .22 (REF)

Item	P/N	Description	Instl/-1
	-1	Condenser Installation	\
1	MD900AC-7000-1	Condenser Assy	1
2	MD900AC-7020-13	Angle Bracket	1
3	MD900AC-7020-14	Side Cover	1
4	MD900AC-7508-1	Adapter Jetfan Outlet	2
5	MD900AC-7508-12	Ring	2
6	MD900AC-7508-17	Frame	1
7	MD900AC-7508-21	Support	1
8	MD900AC-7508-23	Spacer	1
9	MD900AC-7508-20	Clip	2
10	MS21059L08	Nutplate	18
11	MS27039-01-06	Screw	26
12	AN960-10L	Washer	12
13	AN525-	Screw	4
14	MS21059-L	Nutplate	4
15	AN960-8L	Washer	4
16	MS27036-C-08-09	Screw	5
17	MS27036-C-08-09	Screw	17
18	CAT-24	Duct	42"

Drawn D KF
Date 03-14-95
Appr __
Tol .X ± .1
.XX ± .03
.XXX ± .010
ANGLE ± 1 degree

ACC AIR COMM CORPORATION
Boulder, CO 80301

TITLE: Installation-Condenser

Dwg No. MD900AC-700 | Rev N/C

Rev	Date	Description	Appr

NOTES:

1 Prepare and install wiring and connections per AC43.13.1A. Wire per Mil-W-22759/41.

2 Crimp or solder wire termination per AC43.13-1A.

3 Acceptable to use existing spare wires provided by factory installed wire bundles.

4 Magnacraft.

5 Cover wire and wire connections with insulating tubing. Secure A/R with cable ties.

6 Switch operating pressures: Low Pressure Function -

Open @ 30 psi

Close @ 50 psi

High Pressure Function -

Open @ 335 psi

Close @ 280 psi

7. CAUTION: VERIFY PROPER DIRECTION OF ROTATION OF ALL BLOWERS
*ALL EVAPORATOR (COOLING UNITS)BLOWERS:
TOP EDGE OF BLOWER WHEEL SHOULD ROTATE
TOWARD AIR OUTLET.

8. Existing Hardware.

Item	P/N	Description	Instl-1
	-1	Installation	\
1	ES57008-1	Binary Pressure Switch	1
2	220-214	Temp Control Switch (AIR/mfg 9438-34)	1
3	W389DCX-8	Relay 4	1

Drawn D KF
Date 03-14-95
Appr
Tol .X ± .1
.XX ± .03
.XXX ± .010
ANGLE ± 1 degree

ACC AIR COMM CORPORATION
Boulder, CO 80301

TITLE: Installation-Electrical System

Dwg No. MD900AC-800 | Rev N/C

Appendix B

System Trouble-Shooting Supplement

Air Conditioning System Service Tools

The basic AC tools that are discussed in this section include:

1. Recovery/Recycling Station
2. Refrigerant Dispensing Valves & Containers
3. Manifold Gauge Set
4. System Service Valves (R12)
5. System Service Valves (R134a)
6. Vacuum Pumps
7. Leak Detectors
8. Flushing Kit

1. Recovery/Recycling Station

The recovery recycling station performs two closed loop processes. The station removes the refrigerant from an AC system in the **recovery** mode. The refrigerant is contained in an external cylinder for storing, recycling, reclaiming, or transporting. Typically, the refrigerant is not reusable until it is recycled. Contaminants in the refrigerant are reduced in the **recycle** mode. The contaminants could include moisture, acidity, and particulate matter.

Note: Separate stations are required for R12 and R134a.

2. Refrigerant Dispensing Valves & Containers

Bulk containers should always be used with a scale or charging station capable of measuring the refrigerant put into the system.

WARNING

All containers with refrigerant are under pressure (to contain the refrigerant). Any heat will increase that pressure. The containers are not designed to withstand excessive heat even when empty, and should never be exposed to high heat or flame because they can explode. Containers must be certified as meeting DOT CFR Title 49 requirements.

There are several other tools that could be used when charging an AC system with refrigerant. These are a charging meter (refrigerant scale) or a charging station. They will not be described in this document.

3. Manifold Gauge Set

The manifold gauge set is the tool used for internal system diagnosis and service. A typical manifold has two screw type hand valves to control access to the system, two gauges and three hoses. The gauges are use to read system presser or vacuum. The manifold and hoses are for access to the inside of an air conditioner, to remove air and moisture, and to put in or remove refrigerant form the system. Shutoff valves are required within 12 inches of the hose ends to minimize refrigerant loss.

Manifold gauge sets are color coded. An R12 gauge set normally has a blue low side hose, a red high side hose, and a yellow or white utility (center)hose. An R134a gauge set will have a blue hose with a black stripe for the low side, a red hose with a black stripe for the high side, and a yellow hose with a black stripe for the utility (center) hose.

Different style end fittings are used on R12 and R134a hose sets. R12 hose sets use a 1/4 female refrigeration flare (FFL) on all hose ends. A shutoff valve is required on all three hosed within 12 inches of the end connected to the AC system or service equipment. R134a hose sets use a 1/2 ACME female nut on the gauge end,. Special quick disconnect couplings are normally combined with a shutoff valve on the high and low side hoses. The free end of the utility hose contains a 1/2 ACME female nut and a shutoff device within 12 inches of the hose end.

These special hoses and fittings are designed to minimize refrigerant loss and to preclude putting the wring refrigerant in a system.

Two hoses (left and right) connect to the low and high sides of the system, usually at the compressor on R12 systems. The center (utility) hose is used to remove refrigerant from the system, evacuate air and moisture, or add refrigerant. Gauges are calibrated for either high or low pressure and vacuum. The term compound gauge set is often used because the low pressure gauge responds to pressure and vacuum. Separate gauge sets are required for R12 and R134a.

CAUTION

Many gauges have dials with metric and US scales to measure pressure. The more expensive manifold gauge sets have liquid filled gauges and additional valves and fittings incorporated in the manifold. All gauges are breakable and should be handled with a reasonable amount of care.

The high pressure gauge registers system pressure from 0 to 500 PSI. The low pressure gauge registers pressure from 0 to 150 PSI clockwise, and vacuum from 0 to 30 inches Hg counter-clockwise.

There are a few important rules and procedures you must follow concerning gauge set hookup. Both the rules and procedure are for your safety and to protect the AC system. The basic rules are covered briefly here. Gauge set hookup should not be done until after you have made a complete visual and performance inspection of all AC system components.

CAUTION

Never attempt to hook up the manifold gauge set with the engine running. Never hook up the gauge set until you have checked to be sure the hand valves on the manifold are closed. Never hookup the gauges to the AC system until you have made a visual and performance inspection.

4. System Service Valves (R12 Only)

System service valves allow safe access to the system inside of an AC system through the manifold gauge set. There are usually two (2) service ports mounted in an easily accessible area for access to the low and high pressure sides of the system.

Two types of service valves are in common use today--stem type and Schrader. The stem type valve stems screw in and out. They may be used to isolate the compressor from the rest of the system for fast compressor replacement. The Schrader type valve functions like a tire air valve. They are easy to incorporate in other locations in the system.

Note: Many systems have extra service valves (Schrader) in the system. These valves accommodate pressure switches or provide another service port. The new R134a refrigerant uses special service fittings to prevent the mixing of refrigerants and oil.

5. System Service Valve (R134a only)

New and unique service hose fittings have been specified for R134a systems. Their purpose is to avoid cross-mixing of refrigerants and lubricants with R12 based systems. The service ports on the system are quick disconnect type with no external threads.

6. Vacuum Pumps

Air and moisture inside an air conditioner contaminate the system. They combine with refrigerant and refrigerant oil to form acid and sludge. Moisture inside a system can freeze at the expansion valve orifice, blocking the flow of refrigerant temporarily. The result is erratic system function. A vacuum pump is used to remove air and moisture from the inside of hoses and components of the air conditioner, but special care must be taken to keep components clean and moisture free.

When the vacuum pump is hooked up to the system through the manifold gauge set (and the service valves are open), the pump sucks air out. The result is a negative pressure of vacuum. The air is removed quickly, in just a few minutes. However, the humidity in the air may condense inside the system and this moisture must be removed. Moisture will vaporize in a vacuum when a sufficient vacuum level is reached. Vacuum level is measured in inches of mercury. The vacuum pump must operate long enough to cause any condensed moisture inside to vaporize so the pump can suck it out of the system.

In some applications it is most difficult to remove the moisture. The hoses used to connect the AC components in aircraft may be ten times longer than in other AC systems and may have more bends and connections where moisture can hide. For this reason, vacuum pump capacity and how long you use the pump are important. A higher pump capacity and longer pumping time help insure that all moisture is out of the system. There are two types of vacuum pumps, rotary vane and piston type. They require an electrical source for power. The rotary vane pump is thought by many to be superior because it is powerful and quiet.

7. Leak Detectors

There are two types of leak detectors in popular use. The least expensive is called a Halide leak detector and is made from a propane torch. The other is called an electronic leak detector. Electronic detectors operate on one of two principals, positive ion or negative corona. Halide leak detectors should not be used for aircraft AC installations.

Electronic Leak Detector

Electronic leak detectors are safer than the Halide system and about ten times more sensitive. Some designs can detect an R12 or R134a leak as low as one half ounce per year. There are two types of electronic detectors, positive ion and negative corona. These technical terms, positive ion and negative corona, are used in describing the electronic elements and their function in these detectors. The negative corona type detector has a longer service life and requires less power.

Electronic detectors have a probe that is moved around the AC system. Where refrigerant is present, a change is current flow inside the probe is sensed by an electrical circuit. This activates a buzzer which signals the user about the presence of a refrigerant leak.

8. Flushing Kit

A flushing kit is used to remove contaminants from AC system hoses, evaporator and condenser. Any other components should be bench checked or replaced as flushing is either not effective or will cause damage. Flushing these components is recommended when you replace the compressor or find contamination in other system components (receiver-drier, expansion valve, or at connections). Flushing must be done with a “closed-loop” flushing kit using the Recovery/Recycle station.

TROUBLESHOOTING & SERVICE PROCEDURES

If your AC visual, electrical and leak inspections don't turn up any problems, save time by hooking up the manifold gauge set before you make the performance test. If you find a leak and can correct it easily by tightening a connection, do so. But if too much refrigerant leaked out, you may have to add some refrigerant to the system for an effective performance test. We will get into detail on troubleshooting with gauges after we explain manifold gauge set installation and adding refrigerant.

Manifold Gauge Set Installation

CAUTION

Never hook up the gauge set when the engine and air conditioner are running. Be sure all the valves on the manifold are closed all the way (turn them clockwise). Check the hose connections on the manifold for tightness.

Locate the low and high side system service fittings and remove their protective caps. Position or hang the manifold gauge set in a convenient location.

The manifold gauge set is a necessary tool in troubleshooting AC system problems. The following steps are performed during and after installing the manifold gauge set:

1. Purging Air from the Gauge Set Hoses
2. Adding Refrigerant to the System
3. Stabilizing the AC System

1. Purging Air From Gauge Set Hoses

Environmental regulations require that all service hoses have a shutoff valve within 12 inches of the service end. These valves are required to ensure only a minimal amount of refrigerant is lost to the atmosphere. R-12 gauge set hoses have a valve near the end of all three hoses. R-134a gauge sets have a combination quick disconnect and shutoff valve on the high and low sides. The utility (center) hose also requires a valve.

The initial purging is best accomplished when connected to recovery or recycle equipment. Figure 3 illustrates the gauge set connections for purging and refrigeration recovery.

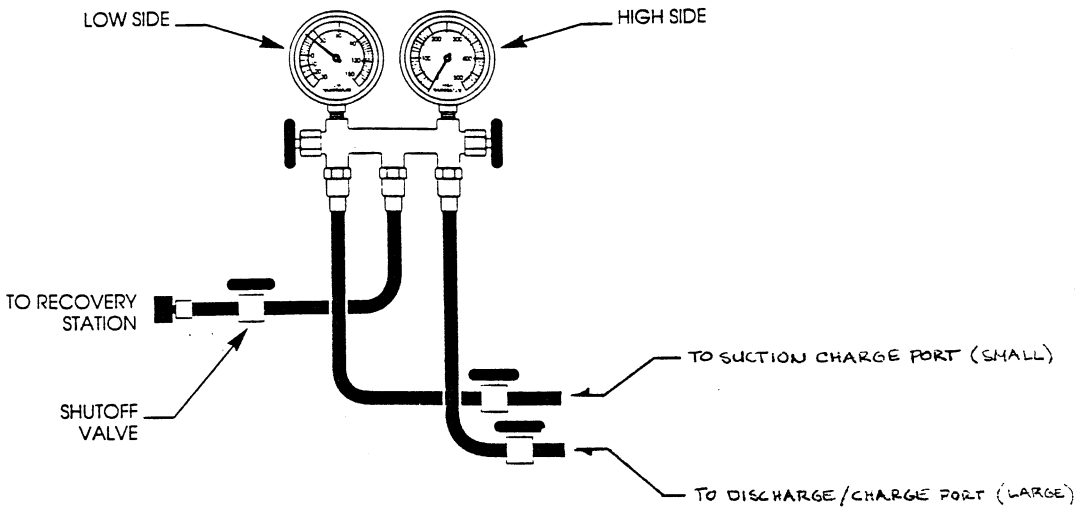


Figure 3
The purging setup for manifold gauge set and compressor service valves are shown here.

Note: The manifold gauges read system pressure when the hand valves are closed if the hose end valves, and the stem type service valves (if included) are open.

2. Adding Refrigerant to the System

Now that the gauges are connected, you may need to add some refrigerant to the AC system before you can do an effective performance inspection. However, if leaks are obvious they should be repaired prior to adding refrigerant.

Note: Loss of some refrigerant is not unusual over an extended period of time. Adding refrigerant is a typical procedure when the AC system is maintained on a regular basis.

When adding refrigerant to the system, connect the center hose from the manifold gauge set to the refrigerant dispensing valve on the container.

2. Adding Refrigerant to the System

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Note: Loss of some refrigerant is not unusual over an extended period of time. Adding refrigerant is a typical procedure when the AC system is maintained on a regular basis.

When adding refrigerant to the system, connect the center hose from the manifold gauge set to the refrigerant dispensing valve on the container. (You may need to purge the air from that hose after you make the connection)

Check the gauges for unusually high or low readings, or a lack of pressure. Following this procedure, and using your knowledge and experience, decide if it is safe and makes sense to add refrigerant in order to make your full performance inspection.

Your are now ready to add refrigerant to the system. For your safety and to prevent system damage use the following procedure.

1. Turn Air Conditioner on and allow system to stabilize while running for a few minutes.

CAUTION

Do not open the high pressure hand valve on the manifold gauge set. The compressor could pump refrigerant into the container and cause it to BURST. Be sure to keep the refrigerant container upright to prevent liquid refrigerant from entering the compressor.

2. Open the refrigerant dispensing valve on the container and then the low pressure hand valve on the manifold. This allows refrigerant to enter the system as a gas on the low pressure or suction side of the compressor. The compressor will pull refrigerant into the system.

3. Add refrigerant until the gauges read in the normal range.

Note: Pressures within the air conditioning system vary with ambient temperature. A normal pressure range is defined as follows:

Low side	30-40 PSIG
High side	95-260 PSIG

Refer to system pressure chart Pg 13.

CAUTION

If the gauges show any abnormally high or low pressures as you are adding refrigerant, stop and investigate for probable cause. Never add more than one pound of refrigerant. If the system is low enough on refrigerant to require more than that amount you should stop and check again for leaks. Then recover all of the refrigerant, repair, evacuate and recharge the air conditioner. You may want to add dry nitrogen gas to the AC system instead of R134a if pressures are below normal and a leak is suspected. Nitrogen gas is sold in cylinders under high pressure, 1800 to 2000 PSI. Be sure the cylinder has a pressure regulating valve to control the pressure when dispensing nitrogen gas. Dispose the gas at no more than 200-250 psi, as this is sufficient pressure to cause or indicate a leak point.

4. When the gauges show normal, close the hand valve on the manifold, the hose end shutoff valve, and the valve on the refrigerant container. You can now proceed with the performance inspection.

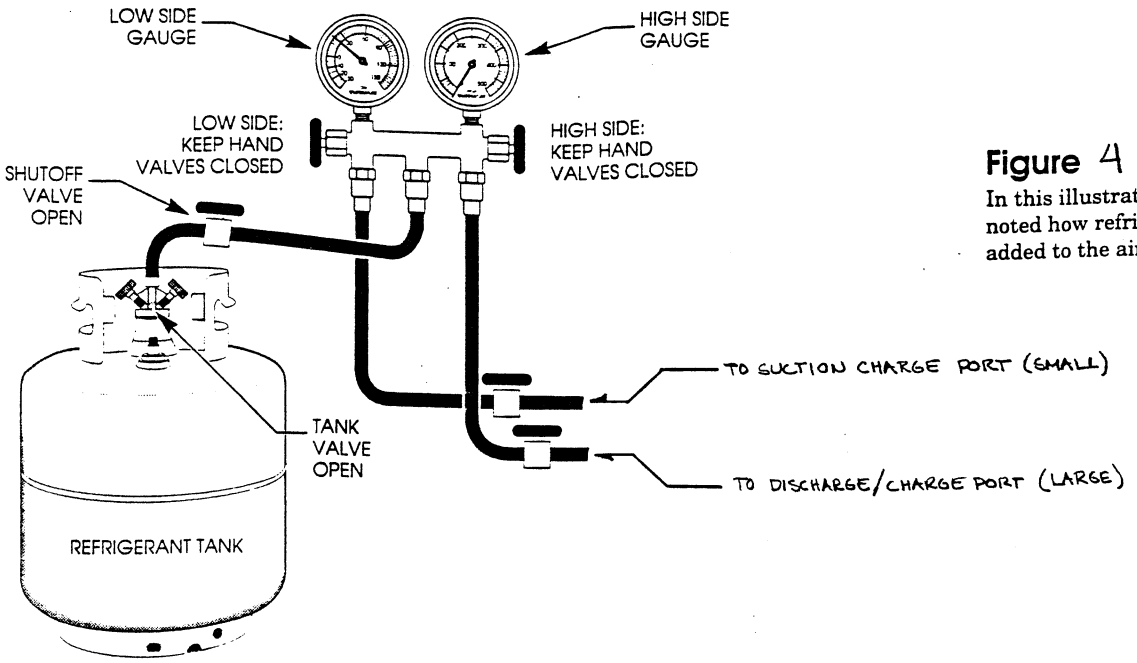


Figure 4
In this illustration we have noted how refrigerant is added to the air conditioner.

This section contains information on troubleshooting AC systems by analyzing Manifold Gauge Set Readings. Some of the Tip sections refer to bubbles or streaks in the sight glass. Sight glass information should not be used for troubleshooting because it is sometimes unreliable. Please disregard the information which refers to the sight glass.

Troubleshooting by Manifold Gauge Set Readings

The series of figures that follow (Figures 6 through 15) show gauges with typical readings indicating AC system problems. Each figure is followed by troubleshooting tips, probable causes for the gauge readings shown, and appropriate service and repair procedures.

Low Refrigerant Charge in the System

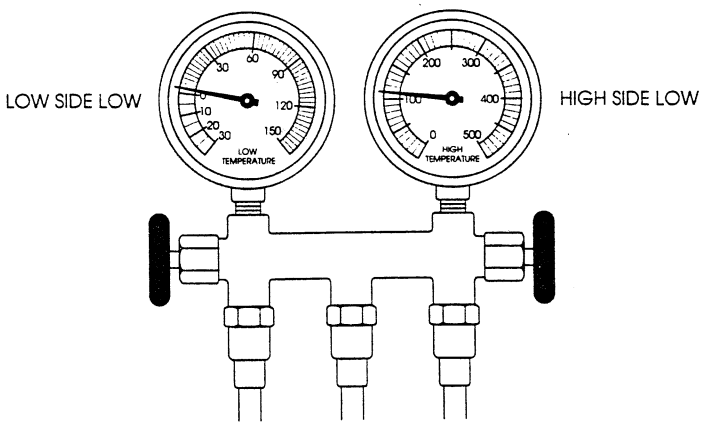


Figure 5
Gauge reading, low refrigerant charge in the system.

Tip: You see bubbles in the sight glass. The air from vents in the cab is only slightly cool.

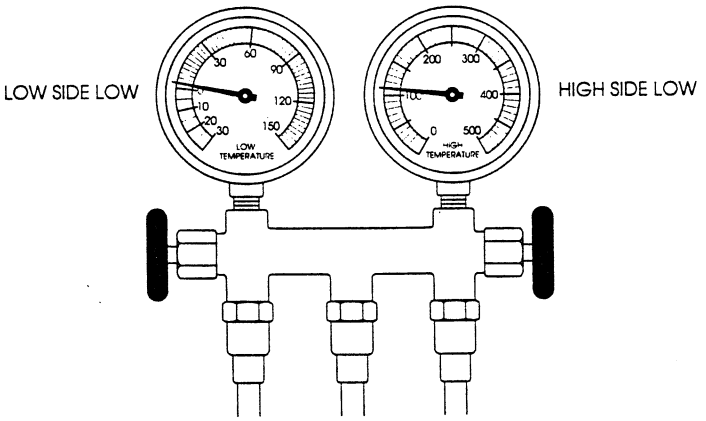
Cause: Insufficient refrigerant (charge) in the system.

Repair Procedure:

Check for leaks with your leak detector. If you find a leak at a connection, tighten it then add refrigerant as necessary. If a component or line is leaking (defective), recover all refrigerant from the system. Replace the defective part and then check the compressor oil level and replace missing oil. Evacuate and recharge with refrigerant, then check AC operation and performance.

Figure 6
Gauge reading, extremely low refrigerant charge in system.

Extremely Low Refrigerant Charge in the System



Tip: The air from vents in the cab seems warm. If there is a low pressure or Trinary™ switch in the system it may have shut off the compressor (clutch).

Cause: Extremely low or no refrigerant in the system. There is a leak in the system.

Repair Procedure:

Add refrigerant to the system, at least half of the normal full charge amount. Then perform your leak test. As an alternative to a refrigerant, add dry nitrogen gas to the system and then test for leaks.

Note: It may be necessary to use a jumper wire to bypass some types of low pressure cutout switches to operate the compressor (clutch) when you add refrigerant to the system.

After finding a leak, recover all refrigerant from the system and repair the leak. Check the compressor and replace any refrigeration oil lost due to leakage. Evacuate and recharge the system with refrigerant, then check AC operation and performance.

Air and/or Moisture in the System

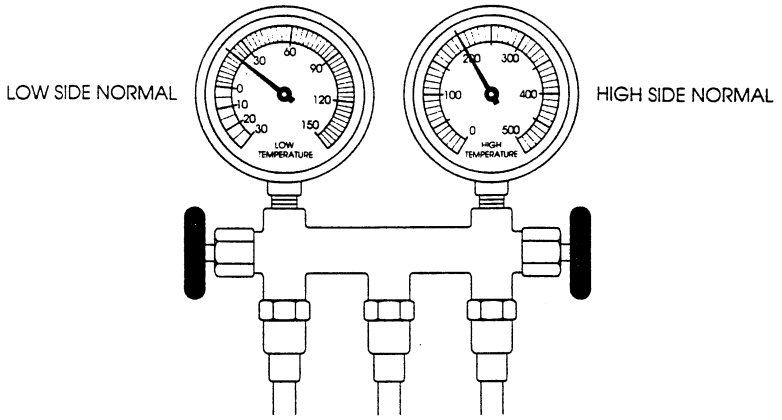


Figure 7
Gauge reading, air and/or moisture in the system.

Tip:

The air from vents in the cab is only slightly cool. In a cycling clutch type system with a thermostatic switch, the switch may not cycle the clutch on and off, so the low pressure gauge will not fluctuate.

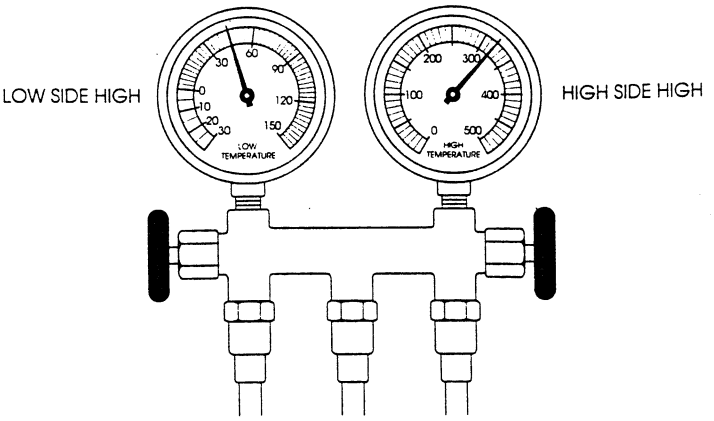
Cause: Air and/or moisture in the system.

Repair Procedure:

Test for leaks, especially around the compressor shaft seal area. When the leak is found, recover refrigerant from the system and repair the leak. Replace the receiver-drier or accumulator because the desiccant may be saturated with moisture (there is no way to tell). Check the compressor and replace any refrigeration oil lost due to leakage. Evacuate and recharge the system with refrigerant, then check AC operation and performance.

Figure 8
Gauge reading, excessive air and/or moisture in the system.

Excessive Air and/or Moisture in the System



Tip: Air from vents in the cab is only slightly cool.

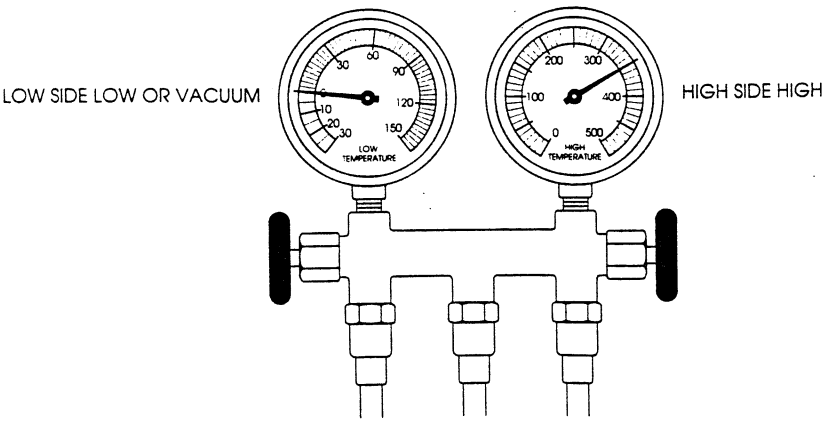
Cause: System contains excessive air and/or moisture.

Repair Procedure:

Test for leaks, recover refrigerant from the system and repair the leak. Depending on the type of system, replace the receiver-drier or accumulator. The desiccant is saturated with moisture. Check and replace any compressor oil lost due to leakage. Evacuate and recharge the system, then check AC operation and performance.

Figure 9
Gauge reading, expansion valve stuck closed.

Expansion Valve Stuck Closed or Plugged



Tip: Air from vents in the cab is only slightly cool. The expansion valve body is frosted or sweating.

Cause:

An expansion valve malfunction could mean the valve is stuck in the closed position, the filter screen is clogged (block type expansion valves do not have filter screens), moisture in the system has frozen at the expansion valve orifice, or the sensing bulb is not operating. In vehicles where the TXV and sensing bulb are accessible, perform the following test. If not accessible, then proceed to *Repair Procedure.*

Test:

1. Warm diaphragm and valve body in your hand or carefully with a heat gun. Activate system and watch to see if the low pressure gauge rises.

2. Next, carefully spray a little nitrogen, or any substance below 32 degrees Fahrenheit, on the capillary coil (bulb) or valve diaphragm. The low side gauge needle should drop and read at a lower (suction) pressure on the gauge. This indicates the valve was part way open and that your action closed it. Repeat the test, but first warm the valve diaphragm or capillary with your hand. If the low side gauge drops again, the valve is not stuck.

3. Clean the surfaces of the evaporator outlet and the capillary coil or bulb. Make sure the coil or bulb is securely clamped to the evaporator outlet tube and the insulation is in place. Next proceed with recovering refrigerant from the system.

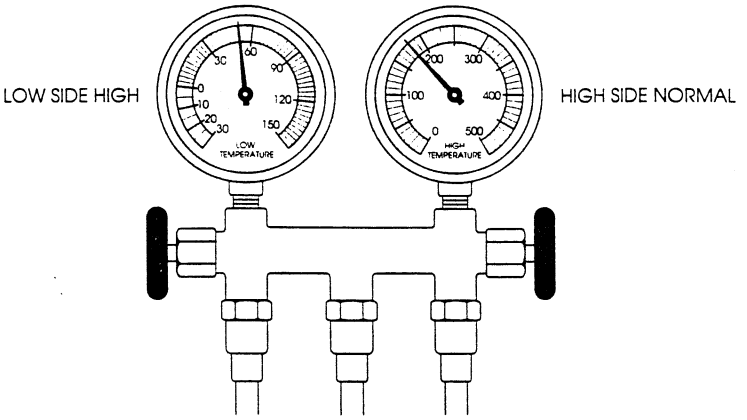
Repair Procedure:

Inspect the expansion valve screen (except block type valves). To do this you must recover all refrigerant from the system. Disconnect the inlet hose fitting from the expansion valve. Remove, clean and replace the screen, then reconnect the hose. Any signs of contamination will **require** flushing the system. Next, replace the receiver-drier. Then evacuate and recharge the system with refrigerant, and check AC operation and performance.

Note: If the expansion valve tests did not cause the low pressure gauge needle to rise and drop, and if the other procedures described did not correct the problem, the expansion valve is defective. You must recover all refrigerant from the system again, and replace the expansion valve and receiver-drier. Evacuate and recharge the system with refrigerant, then check AC operation and performance.

Figure 10
Gauge reading, expansion valve stuck open.

Expansion Valve Stuck Open



Tip: Air from vents in the cab is warm or only slightly cool.

Cause: The expansion valve is stuck open and/or the capillary tube (bulb) is not making proper contact with the evaporator outlet tube. Liquid refrigerant may be flooding the evaporator making it impossible for the refrigerant to vaporize and absorb heat normally. In vehicles where the TXV and sensing bulb are accessible, check the capillary tube for proper mounting and contact with the evaporator outlet tube. Then perform the following test. If the TXV is not accessible, then proceed to *Repair Procedure.*

Test:

1. Operate the AC system on it's coldest setting for a few minutes. Carefully spray a little nitrogen or other cold substance, on to the capillary tube coil (bulb) or head of the valve.

2. The low pressure (suction) side gauge needle should now drop on the gauge. This indicates the valve has closed and is not stuck open. Repeat the test, but first warm the valve diaphragm with your hand.

3. If the low side gauge shows a drop again, the valve is not stuck. Clean the surfaces of the evaporator outlet and the capillary coil or bulb. Make sure the coil or bulb is securely fastened to the evaporator outlet and covered with insulation material. Operate the system and check performance.

Repair Procedure:

If the test did not result in proper operation of the expansion valve, the valve is defective and must be replaced. Recover all refrigerant from the system and replace the expansion valve and the receiver-drier. Evacuate and recharge the system with refrigerant, then check AC operation and performance.

System High Pressure Side Restriction

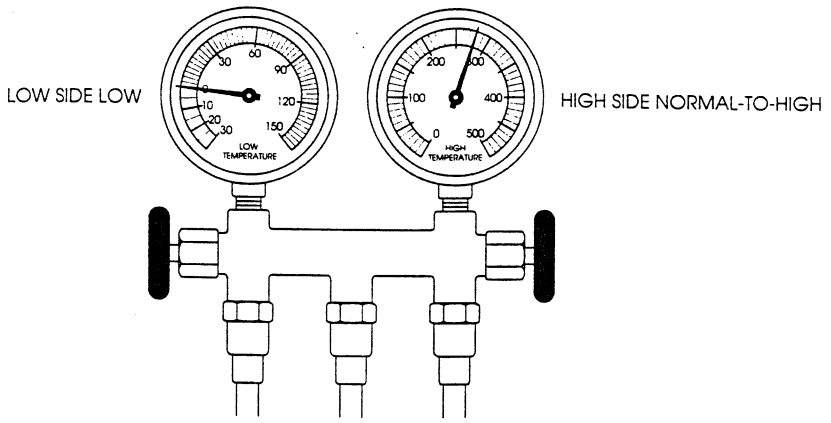


Figure 11
Gauge reading, system high pressure side restriction.

Tip: Air from vents in the cab is only slightly cool. Look for sweat or frost on high side hoses and tubing, and frost appearing right after the point of restriction. The hose or line may be cool to the touch near the restriction.

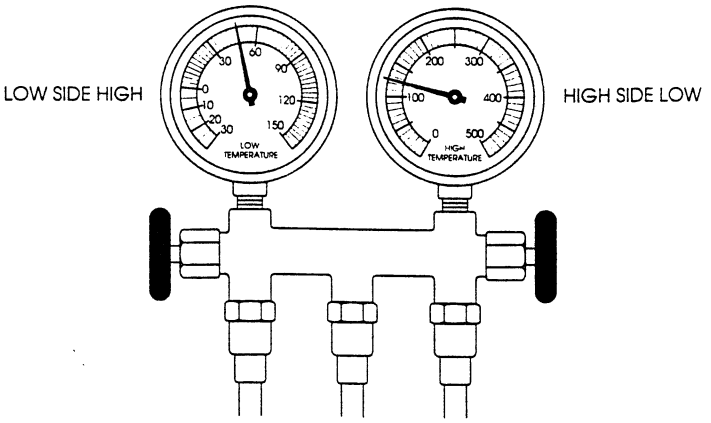
Cause: There could be a kink in a line, or other restriction in the high side of the system.

Repair Procedure:

After you locate the defective component containing the restriction, recover all of the refrigerant. Replace the defective component and the receiver-drier. Evacuate and recharge the system with refrigerant, then check AC operation and performance.

Compressor Malfunction

Figure 12
Gauge reading, compressor malfunction.



Tip: The compressor may be noisy when it operates.

Cause: Defective reed valves or other compressor components. If the compressor is not noisy, there may be a worn or loose compressor clutch drive belt.

Repair Procedure:

If you find the belt worn or loose, replace or tighten it and recheck system performance and gauge readings. To inspect and service the compressor, you must isolate (front seat the stem type compressor service valves) and recover refrigerant, or fully recover R-12 from systems containing Schrader valves. Remove the compressor cylinder head and check the appearance of the reed valve plate assembly. If defective, replace the valve plate and install with new gaskets, or replace the compressor assembly.

If you find particles of desiccant in the compressor, remove and replace it and the receiver-drier. Before doing so, back flush other system components (except the expansion valve) using a flushing kit. If there are stem type valves and you isolate the compressor, the rest of the system must be purged of refrigerant before you can disconnect and flush system components.

After flushing, reassemble the components. Always check the oil level in the compressor, even if you install a new or rebuilt unit. Tighten all connections and evacuate the system. Recharge the air conditioner with refrigerant and check system operation and performance.

Condenser Malfunction or System Overcharge

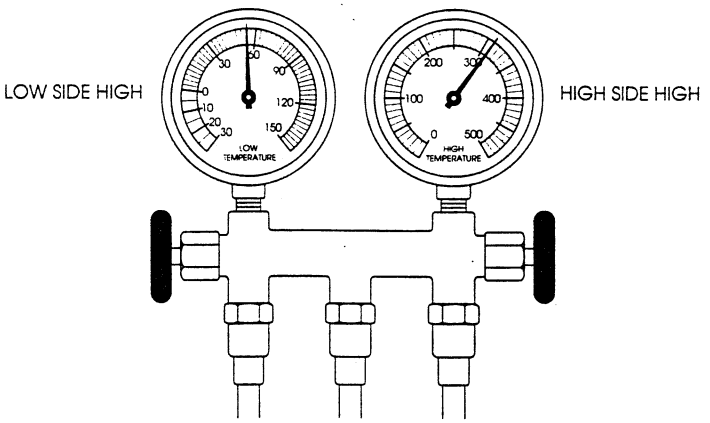


Figure 13
Gauge reading, condenser malfunction or system overcharge.

Tip: The air from vents in the cab may be warm.

The high pressure hoses and lines will be very hot.

Cause: The condenser is not functioning correctly or there may be an overcharge of refrigerant inside the system. Another possibility is lack of (ram) air flow through the condenser fins during testing.

Repair Procedure:

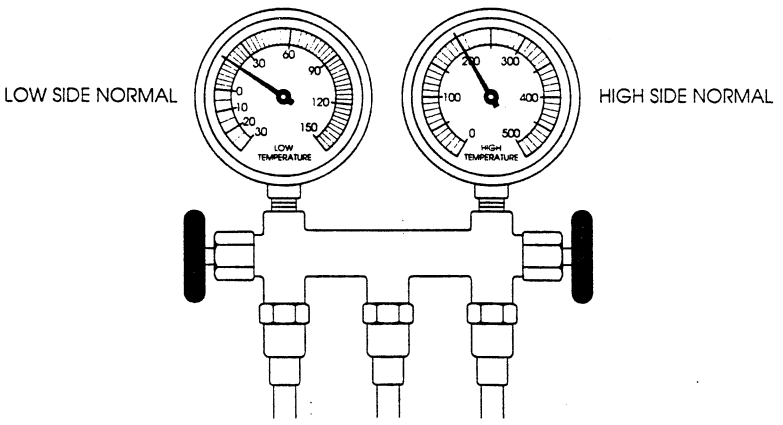
Inspect the condenser for dirt, bugs or other debris and clean if necessary.

If the problem continues, the system may be overcharged (have too much refrigerant inside). Recover the system slowly until low and high pressure gauges read below normal, and bubbles appear in the sight glass. Then add refrigerant (charge the system) until pressures are normal and the bubbles disappear. Add another quarter to half pound of refrigerant and recheck AC system operation, gauge readings and performance.

If the high gauge readings do not change, you should recover all of the refrigerant and flush (it may be partially plugged) or replace the condenser. Also replace the receiver-drier or accumulator. Then connect the components and evacuate the system. Recharge the air conditioner with refrigerant and check system operation and performance.

Figure 14
Gauge reading, thermostatic switch malfunction.

Thermostatic Switch Malfunction



Tip: The low side gauge needle may fluctuate in a very narrow range compared to a normal range.

The low side gauge needle may fluctuate in an above normal range as the clutch cycles. This may be an indication that the thermostat is set too high (someone may have attempted to adjust the factory setting). A new thermostat may have been installed incorrectly (capillary tube not inserted between the evaporator fins in the proper position).

Cause: The thermostatic switch is not functioning properly or at all.

Repair Procedure:

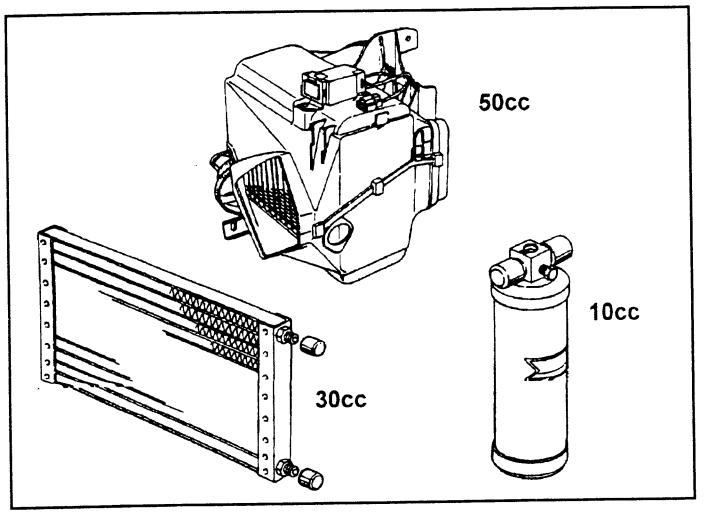
Replace the thermostatic switch. When you remove the old thermostat, replace it with one of the same type. (They operate in a factory preset temperature range.) Take care in removing and handling the thermostat and thin capillary tube attached to it. Don't kink or break the tube.

Position the new thermostat capillary tube at or close to the same location and seating depth between the evaporator coil fins as the old one. Connect the electrical leads.

Review of Frequent Problem Areas

In HVAC systems a limited number of things can go wrong. Moving parts of the compressor, clutch, and expansion valve or refrigerant metering device can malfunction or break down from metal fatigue, contamination, abnormal pressure or lack of lubrication. Electrical connections may corrode, become disconnected or break. Fuses blow from shorts or overload. Belts slip or break.

Vibration from the engine or road surface can work bolts and air or vacuum lines loose, or rub and break or wear parts out. Motors may burn out. The inside of the system can become contaminated from moisture, air or desiccant material breakdown. Refrigerant may leak out of the system quickly or very slowly. Moisture in the system can combine with refrigerant to form acid and attack (corrode) metal parts from the inside. Moisture and refrigeration oil can combine to form sludge that may block refrigerant flow.

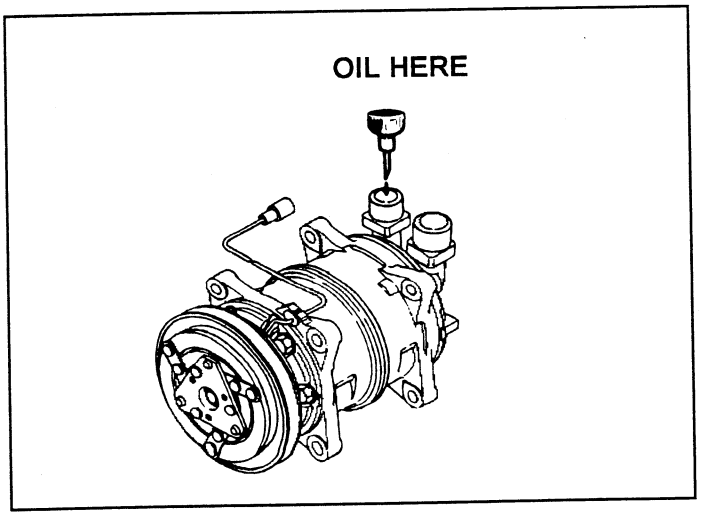


REPLACEMENT OF COMPONENT PARTS

The chart below shows the approximate amount of oil to be added to system when replacing a component.

Component parts to be mounted	Typical amount of oil
Evaporator	50 cm3 (1.7ozs)
Condenser	30 cm3 (1.0ozs)
Receiver-drier	10 cm3 (0.3ozs)

After installing these component parts, check the compressor oil. Refer to **"COMPRESSOR OIL CHECK"** page 16.



OIL CHECK INTERVAL

Unlike engine oil, it is not necessary to frequently check or change the compressor oil. However, it is necessary to check and replenish or replace the compressor oil in the following cases:

1. Whenever the compressor, evaporator, condenser or receiver-drier is replaced.
2. Whenever refrigerant has leaked from the system.
3. Whenever refrigerant is suddenly released from the cooling cycle.
4. Whenever any oil-related problems occur in the cooling cycle.

MAGNETIC CLUTCH RUN IN

1. Install the clutch on the compressor. (see pg. 24)
2. Install the compressor on the engine, and operate the compressor by running the system.
3. Maintain the compressor speed at idle. Operate the A/C switch through the ON/OFF cycle at least 10 times ("ON" for 10 seconds and "OFF" for 10 seconds).