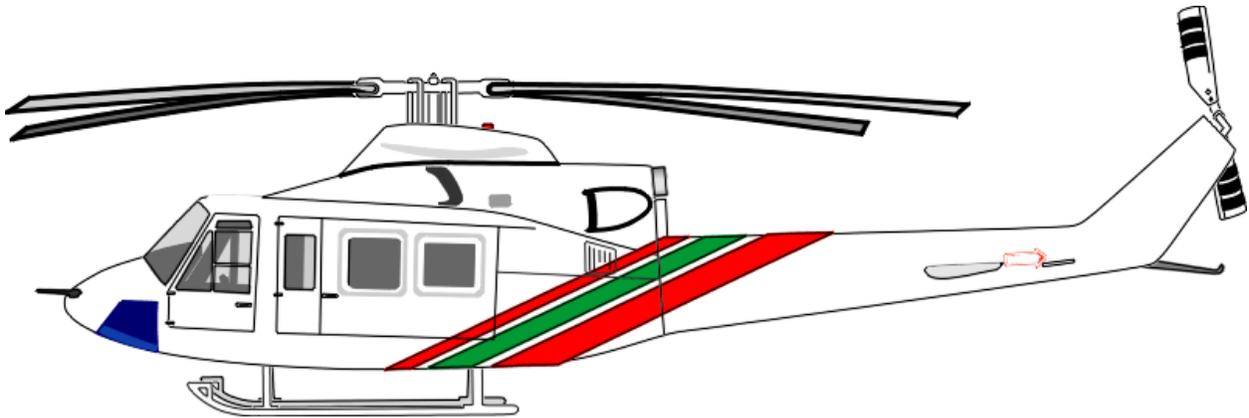


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**INSTRUCTIONS FOR CONTINUED AIRWORTHINESS  
BELL HELICOPTER 412  
AIR CONDITIONING SYSTEM**



**BELL HELICOPTER 412  
AIR CONDITIONING SYSTEM  
WITH GROUND COOLING OPTION**

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RECORD OF REVISIONS

Rev	Date	Description of Change	Approval
1	9/24/2002	Added ground cooling placard to Pg. 4-1.	N/A Prepared by GP
2	10/17/2005	Added 7345 Belt to Suggested Spares List, Pg. 5-5 & compressor drive Illustration 6-1, Pg. 6-7.	N/A Prepared by GP
3	4/24/2006	Added 412AC-607 Fwd Evaporator Installation and 412AC-818 Elect Schematic to Reference Documents, Pg. 0-3; Added 412AC-818 to Troubleshooting, Pg. iv Added Pg. 7-9 & 7-10, 412AC-818 Elect Schematic; Added Model 412CF to Applicability, Chapter 0, Pg. 0-1.	N/A Prepared by RL & GP
4	8/2/2006	Added compressor safety strap, Pg. 6-7; Added safety strap label, Pg. 4-1.	N/A Prepared by GP
5	8/25/2008	Forward and Aft Evaporator blower motor part number change, old P/N 61060-2 replaced by 61064-10, Pg. 5-5.	N/A Prepared by MS
6	2/22/2010	Corrected speed reducer bearing part number to ES33100-3, Pg. 2-1; Corrected various part numbers to Suggested Spares List, Pg. 5-5.	N/A Prepared by RL
7	10/20/2016	Minor ICA change to add applicable kit part no.s, clarify refrigerant oil requirements, allow for use of aft coupling bolts on the Fwd main driveshaft coupling to install balance weights, and updated formatting and typographical errors (revision bars were omitted for formatting and typographical or spelling and grammar updates). Added inspection Procedures and tolerances on inspection periods. Added servicing info for adding refrigerant at cold temps. Changed Tightening procedures for plumbing fittings. Clarified Installation instruction after removal of an item. Added appendix B Weight & Balance.	<p>Prepared By:</p> <p><u>J Byrnes</u>                      <u>Oct 20, 2016</u> Date</p> <p>ACC Approval:</p> <p><u>L B. L.</u>                      <u>10/20/16</u> Signature                      Date</p> <p>FAA Acceptance (Major Change):</p> <p><u>N/A – Meets Minor Change</u> <u>Agreement MR-100-134 9/9/2013</u> Signature                      Date</p>

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CHAPTER 1  
INTRODUCTION

1. SCOPE

The scope of this manual encompasses the scheduled and unscheduled maintenance procedures for the continued airworthiness of the Air Comm Corporation air conditioning system installed in the Bell 412 series helicopter.

2. PURPOSE

The purpose of this manual is to provide the aircraft mechanic in the field the necessary information to maintain the air conditioning system.

3. ARRANGEMENT

This manual is arranged by chapters which are broken down into paragraphs and subparagraphs. All of the chapters and paragraphs are listed in the front of this manual in the Table of Contents, and are further identified by their individual page number.

4. APPLICABILITY

This manual is applicable to Bell Helicopter models 412, 412SP, 412HP, 412EP, and 412CF that are Non-NVIS or NVIS equipped with an Air Comm Corporation kit number 412AC-102-1 thru 412AC-102-6 air conditioner system.

5. DEFINITIONS

The following terms are provided to give a ready reference to the meaning of some of the words contained within this manual. These definitions may differ from those given by a standard dictionary.

- A. **Ambient air temperature:** The temperature of the air surrounding a person or object.
- B. **Charging station:** A piece of air conditioning equipment which normally contains a vacuum pump, manifold set, and a method of measuring and dispensing refrigerant into a system.
- C. **Condensation:** The process of changing a vapor into a liquid.
- D. **Desiccant:** A material used in the receiver/drier bottle, designed to absorb moisture from the refrigerant.
- E. **Evaporate:** To change from a liquid into a vapor.
- F. **Heat load:** The amount of heat which the air conditioner is required to remove from the aircraft cabin.
- G. **Inches of mercury:** A measurement of pressure, normally used for pressures below atmospheric, one inch of mercury is equal to approximately one half pound per square inch.
- H. **Pressure, ambient:** The pressure of the air surrounding a body, normally measured in Pounds per Square inch, or PSI.
- I. **Refrigerant:** A fluid which is used in an air conditioning system to absorb heat from the cabin and carry it outside the helicopter where it can be transferred to the outside air.
- J. **Relative humidity:** The ratio of the amount of water vapor in the air to the amount of water vapor required to saturate the air at the existing temperature.
- K. **Thermostat:** An air conditioning control which senses the temperature of the evaporator coil and causes the system to cycle or by-pass to maintain the proper temperature of cooling air.
- L. **Vacuum:** A negative pressure, or pressure below atmospheric; it is usually expressed in inches of mercury.
- M. **Vapor:** The gaseous state of a material.

6. **ABBREVIATIONS**

<b>InHg:</b>	Inches of Mercury
<b>Lbs:</b>	Pounds
<b>Oz:</b>	Ounces
<b>Psig:</b>	Pounds per Square Inch (guage)
<b>gr:</b>	Grams
<b>kg:</b>	Kilograms
<b>Kg/Cm:</b>	Kilograms per Centimeter
<b>ml:</b>	Milliliters
<b>mm:</b>	Millimeters
<b>Nm</b>	Newton-meters

7. **PRECAUTIONS**

The following precautions are found throughout this manual, and will vary depending on the seriousness of the Hazard or Condition:

- a. **WARNING:** May be a maintenance procedure, practice, condition, etc., which could result in personal injury or loss of life.
- b. **CAUTION:** May be a maintenance procedure, practice, condition, etc., which could result in damage or destruction of equipment.
- c. **NOTE:** May be a maintenance procedure, practice, condition, etc., or a statement which needs to be highlighted.

8. **UNITS OF MEASUREMENT**

All measurements contained within this manual are given in the United States standard measurement, followed by the metric conversion in parentheses.

9. **INFORMATION ESSENTIAL TO THE CONTINUED AIRWORTHINESS OF THE AIR CONDITIONER**

This manual provides information which is required for operation and maintenance of the Air Comm, air conditioning system installed in the Bell model 412 series helicopter. After completion of the air conditioner installation this document must be placed with the appropriate existing aircraft documents.

10. **REFERENCE DOCUMENTS**

The documents that are listed below are General Arrangement and Installation drawing packages. While these drawings are primarily for the installation of the air conditioner system, they are of equal importance in aiding the operator and mechanic in the field to ensure the continued airworthiness of this system.

1. Dwg. 412AC-102-1 / -2 / -3 General Arrangement – Bell model 412, 412SP, 412EP, 412HP, and 412CF Air Conditioning system with Temperature Control.
2. Dwg. 412AC-304 Compressor Installation.
3. Dwg. 412AC-508 / -518(CF) Plumbing Installation.
4. Dwg. 412AC-608 Forward Evaporator Installation.
5. Dwg. 412AC-604 Aft Evaporator Installation.
6. Dwg. 412AC-712 Condenser Installation.
7. Dwg. 412AC-818 Electrical Installation.
8. AC43.13-1A Acceptable Practices, Aircraft Maintenance and Repair.
9. Bell Airframe Repair Manual.

**11. DISTRIBUTION**

This document is to be placed with the aircraft maintenance records at the time of system installation.

Changes will be made to this document in response to “Safety of Flight”, and or “Non-safety of Flight” issues. Any changes will result in a revision to this document. Revisions shall be noted in the Record of Revisions (page i), and on the List of Revisions (page ii) of this manual.

In addition to the revision of the manual, those changes categorized as “Safety of Flight” shall have a Service Bulletin issued to the operator providing the necessary information to comply with, and or to correct, the “Safety of Flight” issue.

Replacement, and or revised copies of this manual maybe acquired by contacting:

Air Comm Corporation Service Department  
1575 W. 124<sup>th</sup> Ave STE 210  
Westminster, CO.80234  
Phone No. 303-440-4075 Fax No. 303-440-6355  
[INFO@aircommcorp.com](mailto:INFO@aircommcorp.com)

**12. CHANGES TO THIS MANUAL**

Changes made to a line or paragraph of this document will be indicated by a vertical bar in the right hand margin, while a complete page change will be indicated by a vertical bar next to the page number.

(Example: Any changes will appear with a vertical bar next to that change). —————→

**13. AIR CONDITIONER FEATURES**

The vapor cycle air conditioner features two forward mounted evaporators (cockpit), one aft mounted evaporator (main cabin), one condenser, and a compressor driven by the main transmission drive shaft. These components combine to provide “conditioned air” through the existing air distribution system, when the engines are operating during both ground and flight operations.

This air conditioner also incorporates a “Ground Cooling” pallet located in the avionics compartment on the R/H side of the aircraft. The Ground Cooling unit is powered by a Ground Power Unit (GPU), plugged into the aircraft auxiliary power plug.

ACC provides cockpit and cabin window reflectors for use with the ground cooling unit. Use of these can result in a 20° F drop in cabin temperature with the ground cooling unit operating.

This system can be operated in either the Air Condition (A/C), or Blower mode. In the A/C mode, conditioned air is provided by the forward and aft evaporators to the cockpit and main cabin areas respectively. In the Blower mode, the evaporator blowers are used to circulate cabin air, while the compressor clutch remains disengaged. If desired, the cabin heater can be operated simultaneously with the A/C or blower mode to achieve the desired cabin temperature, or help defog the cabin windows.

The air conditioning system is connected electrically to the aircraft’s non-essential bus, thus the air conditioner drops off-line in the event of a failure of either engine.

The control panel for the air conditioner system is located in the center pedestal between the pilots and co-pilots seats. This panel consists of a temperature control knob,

annunciator light (which shows on when the system is operating), the A/C & Blower on/off switch, and the Hi/Lo switches for the forward and aft evaporator blowers.

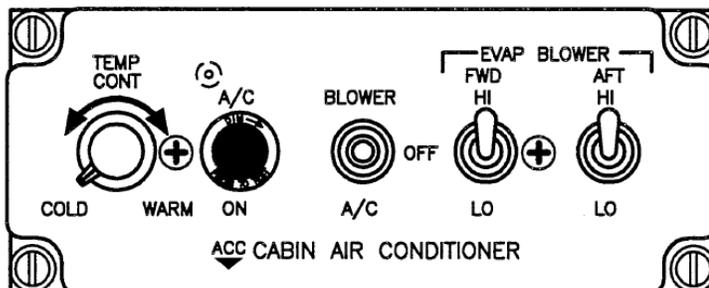


Figure 1: Cockpit A/C Control Panel

The blower motors are two speed operation (Hi/Lo), and may be operated in conjunction with the A/C or Blower modes.

The compressor is mounted on the aft side of the main rotor transmission housing. This compressor is driven by two V-belts and three pulleys arranged to reduce the speed transmitted by the transmission input quill.

Airflow through the condenser heat exchanger is provided by two (2) seven inch diameter 28 volt DC high performance vane axial blowers. The airflow is further augmented by ram air provided through two cutouts located on the front of the upper transmission cowling, while the helicopter is in forward flight.

The aft evaporator assembly is equipped with a thermistor / electronic temperature control unit. The thermistor probe is located in the core of the evaporator heat exchanger. This unit performs two functions; 1. It acts to prevent coil freeze-up by limiting the minimum coil temperature to 32° F (0° C), and 2. It acts as a cabin air temperature control system, by controlling the by-pass of refrigerant through the evaporator coil when the temperature control switch on the control panel is turned up.

The refrigerant plumbing for this system installation incorporates two different types of O-ring fittings:

1. **INSERT O-RING FITTINGS:** These fittings have formed ends that, along with an O-ring, create a seal. Care should be taken when assembling these fittings not to damage the O-ring (i.e. nicking, splitting, or crushing, etc.). The insert O-ring hose and tube ends are identified by green bands adjacent to the fitting. The band color corresponds to the color of the O-ring to be installed at that location. The black O-rings must not be used on these fittings. (See page 6-1 for torquing procedures).
2. **TORQ LOK® O-RING FITTINGS:** These fittings feature a face type O-ring seal. These fittings are much easier to assemble than that of the insert type. Care should be taken when assembling these fittings not to damage the O-ring. The TORQ LOK® O-ring hose and tube fittings are identified by a black band adjacent to the fitting. The band color corresponds to the color of the O-ring to be installed at that location. The green O-rings must not be used on these fittings. (See page 6-1 for torquing procedures).

The system is also equipped with a Hi/Lo pressure switch. This switch is designed to protect the system against over-pressure situations, or in the event of refrigerant loss from the system. The switch also prevents the system from operating in low ambient temperatures below 50° F (10° C).

The switch operating pressures are:

Low Pressure Function:

Cut-out at 28.4 ± 2.8 psi (2.0 ± 0.2 Kg/Cm<sup>2</sup>)

Cut-in at 30.0 ± 4.3 psi (2.1 ± 0.3 Kg/Cm<sup>2</sup>)

High Pressure Function:

Cut-out at 290 ± 28.4 psi (20.4 ± 2.0 Kg/Cm<sup>2</sup>)

Cut-in at 200 ± 42.7 psi (14.0 ± 3.0 Kg/Cm<sup>2</sup>)

#### **14. DESCRIPTION OF THE AIR CONDITIONER AND ITS INSTALLATION**

This section contains a general overview of a Vapor-cycle air conditioning system and how it functions. As the name implies, this type of system operates in a closed loop in which the refrigerant picks up heat from the cabin, and takes it to be released into the outside air. The refrigerant then returns to the cabin to repeat the cycle. The operation of the system is described below.

Liquid refrigerant is contained in the receiver-drier under pressure from the compressor. The receiver-drier also filters the refrigerant through a material known as desiccant. The desiccant ensures that the fluid leaving this component is free of any water or other contaminants.

The low pressure (suction line) from the compressor is attached to the evaporator lines, and causes the refrigerant to be pulled out of the receiver-drier and through the expansion valves. The expansion valves serve as a controlled spray orifice, to spray the correct amount of refrigerant into the evaporator.

This regulation of refrigerant allows the liquid to absorb the heat from the cabin air, and transforms it to a vaporous state just prior to exiting the evaporator assembly. This extraction of heat is the cooling action that the system is designed to achieve.

The low pressure vapor is then drawn into the compressor where its pressure is raised to approximately 200 psi, and its temperature to around 200° F (93.3° C). This high pressure / high temperature vapor then travels to the condenser, (a heat exchanger cooled by a flow of outside air). Heat is extracted from the refrigerant, and as it cools it condenses back into a liquid and flows into the receiver-drier, ready to repeat the cycle.

15. REFRIGERATION CYCLE ILLUSTRATION

NOTE: This illustration is provided as a reference only and may not match actual installation

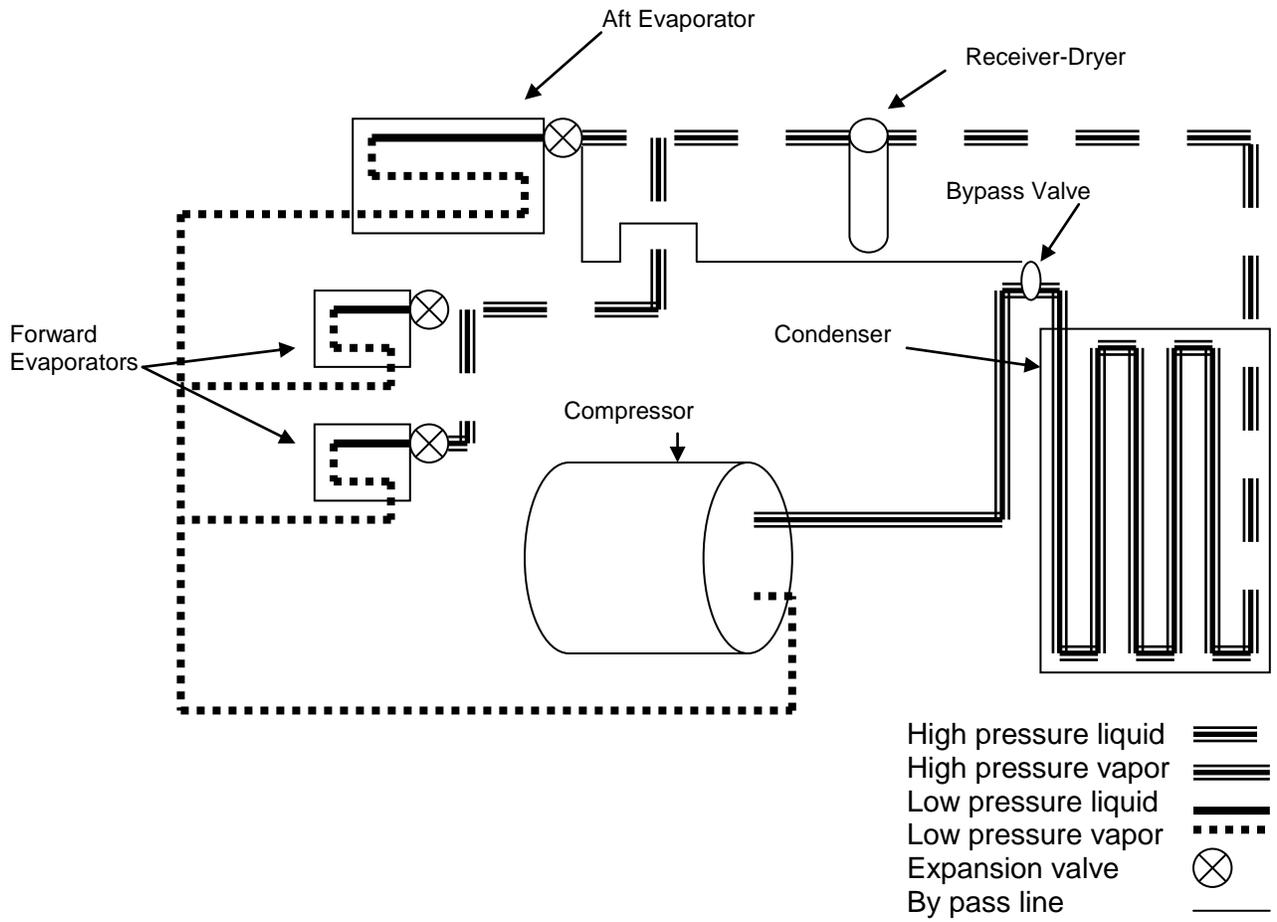


Figure 2: Refrigeration Cycle Illustration

**CHAPTER 2**  
**AIRWORTHINESS LIMITATION SECTION**

**1. AIRWORTHINESS LIMITATIONS**

The Airworthiness limitations section is FAA approved and specifies inspections and other maintenance required under Sections 43.16 and 91.403 of Federal Aviation Regulations unless an alternative program has been FAA approved.

**No airworthiness limitations are associated with this type design change.**

FAA approval:

---

ACO Representative

Date

**CHAPTER 3  
INSPECTIONS**

**1. INSPECTION REQUIREMENTS**

PERIODIC INSPECTIONS  
(Hours are aircraft time)

Item	Prior to Cooling Season	Every 25 Hours of Operation, +/- 3 hrs.	Every 100 Hours of Operation, +/- 10 hrs.	Special Inspection Information
Evaporator Blower Hi/Lo Operation	X		X	Check for operation and security.
Condenser Blower Motor & Fan Assy.	X		X	Check for operation and security. See Overhaul / Replacement Schedule below.
Condenser Assy. Mounting & Housing	X		X	Check for blockage of heat exchanger fins, operation, and security.
Compressor Drive Belts for Tension & Wear	X	X	X	Check belt tension for signs of excessive wear, check drive pulleys for security and wear.
Placards & Markings	X		X	Check for security and legibility.
Compressor Assy.	X	X	X	Check for operation, security of attaching hardware, and signs of oil or refrigerant leaks. See Replacement Schedule below.
Compressor Mount	X	X	X	Check for operation of the speed reducer drive pulley, and security of the attaching hardware.
Aft Evaporator Foam Insulation	X			Check for security and signs of deterioration, replace as necessary.
Plumbing and Fittings	X		X	Check for security and signs of oil or refrigerant leaks.
Speed Reducer Bearing	X	X	X	Apply a 2 to 3 lb (.9 to 1.4 Kg) force to the edge of the pulley, as shown by Figure 11, Page 32 Any free-play of the pulley/bearing assembly in the direction X-X is cause for immediate replacement of bearing.

**2. COMPONENT OVERHAUL / REPLACEMENT SCHEDULE**  
(Hours are aircraft time)

Description	Part Number	Overhaul / Replacement Hours
Condenser Blower 412AC-7058-15 Motor & Fan replacement	ES73131-1 (New) ES73131-2 (Overhauled)	The blower manufacturer recommended TBO is 500 hrs. At the discretion of the operator it is acceptable to operate the blower until failure. A blower failure will result in a reduction in cooling.
Compressor Assy. Ground Cooling Compressor Assy	412AC-3542-2 412AC-3020-1	The compressor manufacturer recommended TBO is 1000 hrs. At the discretion of the operator it is acceptable to operate the compressor until failure. A compressor failure will result in a loss of cooling.
Ground Cooling Drive Motor Assembly	ES61140-1	The motor manufacturer recommended TBO is 500 hrs. At the discretion of the operator, it is acceptable to operate the motor until failure. A blower failure will result in a loss of ground cooling, but no safety-of-flight issues are involved.
Speed Reducer Bearing	ES33100-3 (35BD219DUM Obsolete Bearing)	It is recommended that the Speed Reducer Bearing be replaced every 900 hours of operation. A bearing failure could result in a broken belt and loss of cooling.

### 3. INSPECTION PROCEDURES

#### **NOTE**

Refer to "Chapter 4 location and access" to locate all components for inspection.

#### **A. Inspection of the FWD and AFT evaporator blower motors**

#### **CAUTION**

Fans are designed to operate with the resistance of the entire ducting system. Operation of the evaporator fans with any part of the distribution system removed may cause permanent damage to the fan motor.

#### **WARNING**

Fans may take up to 10 seconds to start after the switch is turned on. Keep hands away from fan whenever switch is in "BLOWER" or "A/C" positions.

- a. At the Cockpit's Air Conditioner Control Panel place the AIR COND switch in the BLOWER position and verify:
  1. That both the fwd and aft fans are activated and operating – Place blower switches to "low" and "high" to verify blowers increase and decrease speed accordingly.
  2. That the condenser fan is non-operational.
  3. That the compressor clutch is disengaged.
- b. Place the AIR COND switch in the OFF position and verify that:
  1. That both the fwd and aft fans deactivate
  2. That the compressor clutch remains disengaged.

#### **B. Inspection of the air conditioner condenser**

#### **NOTE**

This inspection may be performed with the air conditioner charged with refrigerant or it may be performed with no refrigerant in the system. In the case where there is no refrigerant in the system or the system is low on refrigerant or in the case where the ambient temperature is low, the binary switch will need to be jumpered. The temporary installation of a jumper wire across the terminals of the binary switch will do no harm even if it was not necessary.

#### **CAUTION**

The temporary jumper **must** be removed after this inspection is completed.

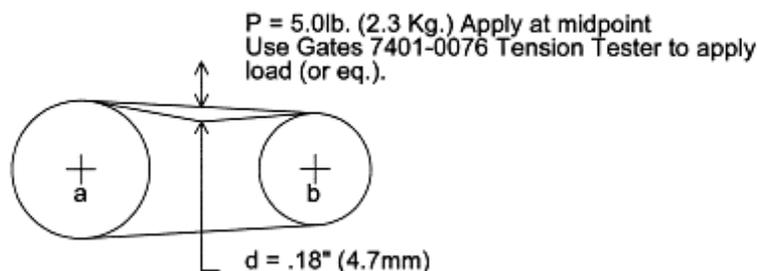
- a. Visually inspect condenser air inlet for any obstructions or debris. Airflow in this area is critical for air conditioner operation.
- b. Install a jumper between the contacts of the binary switch if required.
- c. Connect 28V ground power to the aircraft and place the A/C mode switch in the "A/C" position and verify that:
  1. Condenser fan is activated and operating. This fan should pull air into the aircraft.
  2. Compressor clutch is engaged. Verify compressor clutch engagement by visually observing the clutch plate clamp to the compressor rotor or an audible click when the switch is moved to "on".

- d. Place the A/C mode switch into the Off position and verify that the condenser fan is deactivated.
- e. Ensure that the jumper wire is removed from the binary switch.

**C. Inspection of compressor drive belt**

- a. Remove transmission cowling to gain access to compressor drive belt and visually inspect the A/C compressor drive belt for the following:
  1. Any signs of excessive wear.
  2. Any signs of glazing.
  3. Any cracks or missing pieces.
  4. Any exposed fibers.
- b. Verify proper belt tension as shown in the illustration shown in Figure 3. Below.

The proper belt tension is achieved using the following procedures:



**Figure 3: belt tension inspection**

**D. Inspection of air conditioner placards and markings.**

- a. Check all air conditioner placards and markings for security and legibility.

**E. Inspection of air conditioner compressor assembly**

**NOTE:**

The air conditioning system must be serviced with refrigerant to perform this inspection

- a. Connect 28V ground power to the aircraft and place the A/C mode switch in the "A/C" position and verify:
  1. Compressor clutch is engaged.
- b. Place air conditioner switch to the OFF position and verify:
  1. Compressor clutch is disengaged.
- c. Visually inspect the compressor assembly for the following:
  1. Security of all attaching hardware.
  2. Signs of refrigerant or oil leaks.
  3. Signs of excessive belt slippage or excessive heat.

**F. Inspection of Air Conditioner Compressor Mount Assy.**

- a. Visually inspect compressor mount of any signs of the following:
  1. Any cracks.
  2. Security of attaching hardware.
  3. Elongation of component mounting holes.
  4. Any loose rivets.

**G. Inspection of Air Conditioner Refrigerant Plumbing**

- b. Visually inspect plumbing and fittings for any signs of the following:
  1. Refrigerant gas or oil leaks.
  2. Chaffing or excessive corrosion.
  3. Security of attaching hardware.

**H. Inspection of Compressor Drive system**

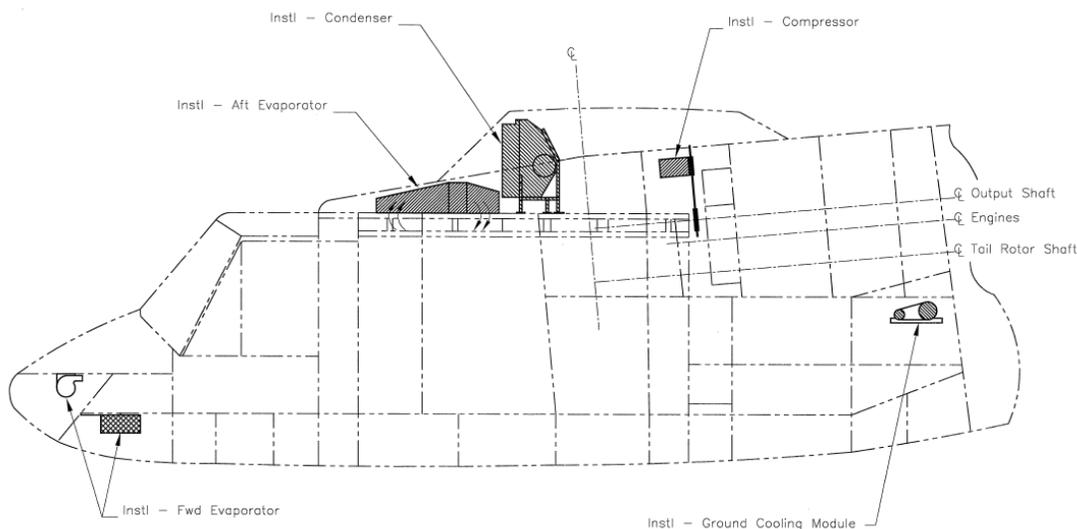
1. Cut the safety wire on the belt tensioning link assembly jam nuts and adjust the tensioning link assembly to loosen the compressor drive belt.
2. Check the S-3532EC drive pulley for play relative to the tail rotor drive shaft, both in the direction of rotation as well as for lateral movement relative to the shaft, and inspect area around the base of the drive ring at the shaft for any buildup of metal dust/powder residue.
3. If there is any detectable looseness, and/or if there is significant metal dust/powder residue present, refer to Section 8 for removal instructions to allow removal and further inspection to determine if the pulley or drive ring need to be replaced.
4. If there is no detectable looseness, and no significant metal dust/powder residue present, re-tension the belt per Section 8.
5. Check security and condition of all related fasteners.

**CHAPTER 4  
LOCATION AND ACCESS**

**1. LOCATION OF AIR CONDITIONER FEATURES**

Nomenclature	Description of Location
Air Conditioner Circuit Breaker Panel	Located on the forward L/H side adjacent to the overhead circuit breaker panel.
Air Conditioner Control Panel	Located in the center pedestal. Exact location may vary depending on how the aircraft is equipped or configured.
Relay Panel Assembly	Located adjacent to the main transmission above the cabin headliner panel aircraft left.
Forward (Cockpit) Evaporators	Mounted in the chin-bubble just forward of the tail rotor control pedals. (One on the pilots and one on the co-pilots side respectively).
Forward Evaporator Blower Assemblies	Located in the nose compartment above the pilots & co-pilots chin-bubbles.
Aft (Main Cabin) Evaporator	Located on the main cabin roof under the forward transmission cowling.
Condenser Assembly	Located just forward of the main transmission on the cabin roof, and just aft of the aft evaporator assembly.
Compressor	Mounted on the aft side of the main transmission housing above the transmission input quill.
Refrigerant Plumbing	Routed from the cabin top, down through the main transmission pylon, to the belly of the aircraft, and forward to the nose area.
Ground Cooling Unit	Located in aft R/H avionics bay, just forward of the Tail boom access, and below the Engine Deck.

**2. LAYOUT OF AIR CONDITIONER SYSTEM**

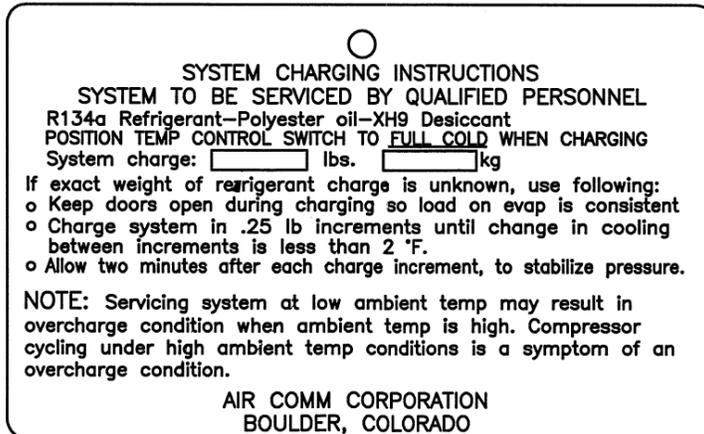


**Figure 4: General Layout of Bell 412 Air Conditioning System**

**CHAPTER 5  
PLACARDS AND MARKINGS**

**1. PLACARD AND MARKING INFORMATION**

**System Charging Instruction Placard**  
(Mounted to the R/H side of the condenser housing)



**NOTE**

Newer systems do not include the “BOULDER, COLORADO” annotation on the System Charging Instructions Placard.

**NOTE**

Systems shipped after July 2015, include both “Polyester oil” and “Ultra PAG oil” in the annotation on the System Charging Instructions Placard.

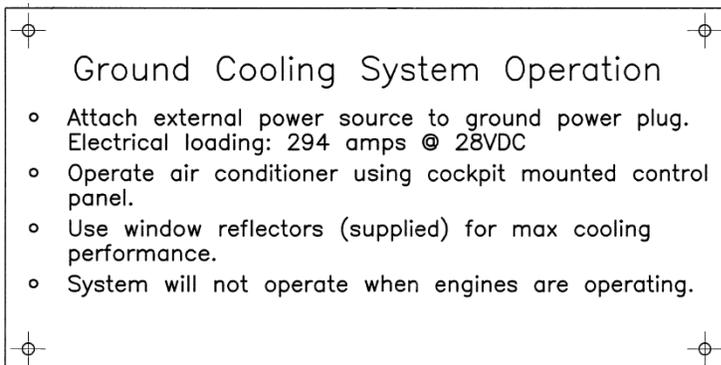
**Compressor Placard**

(mounted on top of the compressor body)



**Compressor Label**

(See page 27 for Safety Strap Installation details)



**Ground Cooling System Placard**  
(Located on top of the ground cooling relay box)

**CHAPTER 6**  
**SERVICING**

**1. SAFETY PRECAUTIONS**

**CAUTION**

Refrigeration servicing should be performed by qualified personnel only.

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 the parts involved and personnel 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 refrigerant from coming into contact with the skin, especially the eyes.

**WARNING**

Always wear safety goggles when servicing any part of the refrigerant system. Should any liquid refrigerant contact the skin or eyes, seek medical attention immediately even if the irritation ceases.

**WARNING**

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

**2. SERVICING INFORMATION**

This system should be serviced by QUALIFIED PERSONNEL ONLY.

- A. A list of suggested servicing equipment is provided later in this chapter.
- B. Connect the service manifold and vacuum pump to the service ports located on the right hand side of the cabin roof adjacent to the aft evaporator.
- C. Turn on the vacuum pump and open both valves to evacuate the system. When the pressure drops to 29.40 InHg (1.9 KgCm) moisture vaporizes and is drawn out of the system by the vacuum pump. Complete removal of moisture is important to prevent blockage of the expansion valves with ice. Leak check the system as described later in this chapter.

**NOTE**

Due to the drop in atmospheric pressure with an increase in altitude, the normal vacuum reading will drop approximately 1" InHg (1 KgCm) for each 1000 ft. (304.8 m) of altitude.

- D. After the system has been evacuated, turn off both manifold valves, and then turn the vacuum pump off. Allow a minimum of 1 hour to check for vacuum leaks (if the system will not hold a vacuum, the system has a fitting leak). It may be necessary to charge the system with 1 or 2 lbs of refrigerant and conduct a leak check survey using an electronic leak detector.

**CAUTION**

It is mandatory that the system be leak free to ensure trouble free operation. Continuous operation of the system with insufficient charge will result in compressor damage.

- E. After the system is proven to be leak free, the system should be evacuated for a minimum of ½ hour before being charged with HFC R134a.
- F. Charging the system with 6.25 lbs. (2.8 Kg.) of R134a refrigerant is the most accurate method of charging. This should be accomplished using the suggested servicing equipment called out in this chapter.
- G. If a charging station is unavailable, the following procedure should be followed. Add an initial refrigerant charge of 2.0 lbs (0.9 Kg.) then continue to add refrigerant until the evaporator outlet air temperature and system suction pressures reach a minimum and subsequently start to increase. When adding the refrigerant after the initial charge, it should be done in increments of 0.2 lbs (89.6 gr.) and a minimum of 10 minutes elapsed time allowed before adding each additional 0.2 lbs. (89.6 gr.) refrigerant charge. The optimum charge occurs when evaporator outlet temperatures are at their lowest. Any additional refrigerant will cause the outlet air temperature to increase and system performance to be degraded.

**WARNING**

If the system is to be charged by operating the compressor it must be charged through the Lo pressure (suction) port only.

Never open the Hi pressure (discharge) valve while the system is operating.

- H. Test-run the system after charging, to confirm the system is working properly.

**CAUTION**

When reclaiming refrigerant be sure to note any oil that is removed from the system and replace the lost oil before or during re-servicing. Compressor failure is possible if the total system oil-charge is not maintained. Excessive system oil charge will reduce cooling performance.

Running the system when the ambient temperature is below 80 °F will present unusual (low) suction and discharge pressures on system gauges. An overcharge condition is likely if the process described in the previous paragraphs A through G is followed when the ambient temperature is below 80 °F. Running the air conditioning system when the outside air temperature is appreciably colder than the normal design operating temperatures may result in damage to the compressor. The following guidelines will provide means to mitigate the chances of system damage.

The following assumes that the system is either a freshly installed system or a previously operated system with a newly installed compressor.

**Ambient temperature above 80°F:**

If the system was charged by refrigerant weight utilizing a charging station and the compressor has not been rotated since the oil and refrigerant were added, then manually rotate the compressor shaft clockwise a minimum of 10 full revolutions prior to running the compressor. A socket or wrench applied to the shaft nut is the

recommended method. Always rotate clockwise to insure against loosening the compressor shaft nut.

If the system was charged per Section 2 paragraph G of this Chapter then disregard manual rotation.

Operate system normally, check for evaporator fan operation on both high and low speed settings. Insure that condenser fans are operating and airflow direction is correct.

**Ambient temperature between 60 °F and 80 °F:**

At these ambient temperatures system charging is to be accomplished by refrigerant weight. The method mentioned in Chapter 6, Section 2, Paragraph G (above) is not applicable at these condenser inlet temperatures. It is recommended that the aircraft heater be used during air conditioner system testing in order to provide a heat load to the evaporators.

Manually rotate the compressor shaft clockwise a minimum of 10 full revolutions prior to running of compressor. A socket or wrench applied to the shaft nut is recommended method. Always rotate clockwise to insure against loosening the compressor shaft nut.

Normal suction and discharge pressures are not expected under these conditions and the evaporators may be cold enough to cause the freeze switch to activate and the bypass valve to open and close in a cyclic pattern.

Even though the bypass valve may be cycling this test may be conducted for sufficient time to thoroughly check for condenser blower and fan operation. Check for evaporator fan operation on both high and low speed settings. Insure that the condenser fan is operating and the airflow direction is correct. Low side pressure may be observed to be higher than expected when the bypass valve is open.

**Ambient Temperatures between 60 °F and 32 °F:**

At these ambient temperatures system charging is to be accomplished by refrigerant weight. The method mentioned in Chapter 6, Section 2, Para. G (above) is not allowed at these condenser inlet temperatures. It is required that the aircraft heater, or another means of elevating the evaporator inlet air, be used during air conditioner system testing in order to provide a heat load to the evaporators.

It is recommended that the aircraft be warmed in a heated hangar immediately prior to running the air conditioner test. Upon removing the aircraft from the heated environment the test should be started within ten minutes or as soon as practical.

Manually rotate the compressor shaft clockwise a minimum of 10 full revolutions prior to running of compressor. A socket or wrench applied to the shaft nut is recommended method. Always rotate clockwise to insure against loosening the compressor shaft nut.

Normal suction and discharge pressures are not expected under these conditions and the evaporators may be cold enough to cause the freeze switch to activate and the bypass valve to open and close in a cyclic pattern.

At these ambient temperatures this test should not be conducted for more than 15 minutes. Testing the evaporator fan operation using the vent position prior to rolling out of the hangar and prior to running the air conditioner system is recommended. Check for evaporator fan operation on both high and low speed settings. Insure that condenser fan is operating and the airflow direction is correct.

**Ambient Temperature less than 32 °F:**

There is no safe way to operate the air conditioning compressor with ambient temperatures below 32 °F. Much of the system can be tested for proper operation even though the compressor cannot be run.

Charge the system by refrigerant weight only.

Manually rotate the compressor shaft clockwise a minimum of 10 full revolutions. A socket or wrench applied to the shaft nut is recommended method. Always rotate clockwise to insure against loosening the compressor shaft nut.

Temporarily disconnect the wire energizing the compressor clutch.

Run the aircraft and turn the switch to air conditioning. Check the condenser fan for operation and correct direction of airflow. Check evaporator fans for airflow on both high and low settings.

**SYSTEM REFRIGERANT & OIL CHARGE**

System Description	Refrigerant Charge		Oil Charge	
412 Air Conditioner	6.25 lbs.	2.8 kg.	9.0 oz. (new comp) 8.5 oz. additional for 412AC-104 or -106 kits	266 ml.  251 ml.

**3. LUBRICATION INFORMATION**

**CAUTION**

This system may be serviced with either Polyolester (POE) or Double End Capped Polyalkylene Glycol (DEC PAG) oil. Polyalkylene Glycol oil is preferred due to its superior lubricating properties and improved compressor service life. There are several types of PAG available. Only the “Double End Capped” type is permissible in Air Comm Corporation air conditioning systems. Double End Capped PAG oil is available from Air Comm Corporation in 8 ounce bottles (P/N ES94006-13). Mixing of POE and PAG is acceptable. Disregard previous statements to the contrary. They referenced PAG oil that was not “Double End Capped”. Current versions of compressors are designed to be operated using PAG oil. Testing by Air Comm Corporation has shown that “Double End Capped” PAG is compatible with POE and can therefore be mixed. “Double End Capped” is a reference to the chemical structure of the molecule and not to the container.

Do not use Mineral oil in this system with R134a refrigerant. Do not use any refrigerant oil other than Double End Capped Polyalkylene Glycol (also known as “ULTRA PAG”) or Polyolester (also POE).

Containers of DEC PAG or POE will absorb moisture if left open (hygroscopic). Keep containers tightly capped when not in use and keep all system components capped while servicing system.

- A. **New Installations** - The total system oil charge is 16.0 oz. (473 ml.) of R134a Ultra PAG Refrigerant Oil. The compressor is charged with 9.0 oz. (266 ml.) of oil at the factory, an additional 7.0 oz. (207 ml.) of oil must be added at the time of the system installation. This oil should be added to the compressor discharge line prior to system charging. These amounts are only applicable to new systems prior to any system operation. A system that has been completely flushed may be treated as a new system for oil quantity.

**CAUTION**

Never add oil to the suction side of the system.

The oil charge is continuously circulated by the refrigerant during the operation of the system. A quantity of oil is trapped by the compressor; it is possible to confirm the system oil charge after the system has operated for a minimum of ten minutes. This is done by checking the oil level in the compressor body.

**NOTE**

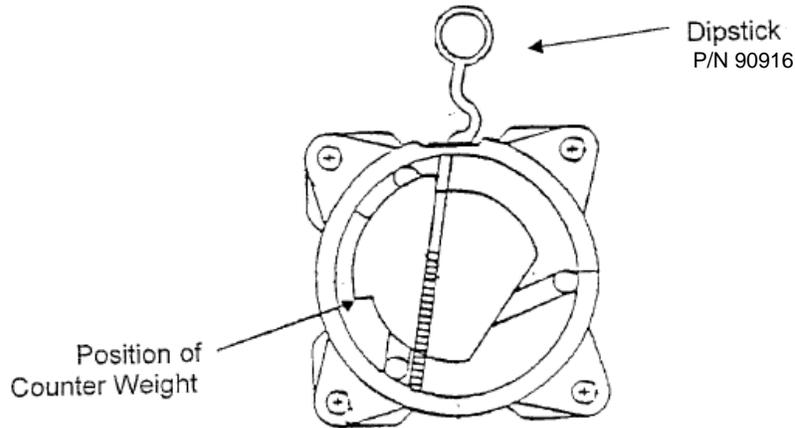
Maintaining the correct amount of refrigerant and refrigerant oil in the system is critical for ensuring the long life of the compressor.

**WARNING**

Discharge the system prior to checking the oil level.

The oil level in the compressor should be checked as follows:

- a. Run the air conditioner compressor for 10 minutes with the engine at idle.
- b. Turn the air conditioner off, and SLOWLY recover all refrigerant from the system, as not to lose any of the oil.
- c. Remove the filler plug from the top of the compressor body.
- d. Using a socket wrench, turn the compressor pulley retaining nut clockwise until the counter weight on the face of the compressor is positioned as shown in Figure 5 below.
- e. Insert the oil dipstick up to the stop as shown in Figure 5 below.
- f. Remove dipstick and count the number of increments (notches) that are covered by oil. The acceptable oil level for this compressor is a minimum of 8 increments.
- g. It may be necessary to add or subtract oil from the compressor to meet these specifications.
- h. Inspect the filler plug O-ring for damage, cleanliness and proper seating, replace if necessary. Torque to 11 – 15 ft. lbs. (15 – 20 N –m).



**Figure 5: Compressor Counter Weight and Dipstick**

- B. Component Replacement** - Once a system is in operation the lubrication is circulated through the system along with the refrigerant. The refrigerant becomes saturated with the oil and carries it throughout the system, lubricating the compressor internal parts. No other component in the air conditioning system requires lubrication. Excessive oil in the system causes a reduction in heat transfer and will result in poor air conditioning performance.
- C. When reclaiming refrigerant, be sure to measure and note any oil that is removed from the system. If a measurement is not available use 1.5 oz. as the estimated loss. Replace any lost oil before or during re-servicing. Reduced compressor life will result if the total system oil charge is not maintained.
- D. Make note of any oil lost due to spillage or leaks during time of installation or maintenance. This oil must be replaced before the air conditioner is returned to service.
- E. The following chart may be used to calculate the amount of oil to be added in case a component is being replaced with a new part.

Component	Oil Amount
Compressor	See Instructions this section
Evaporator	1.0 oz. per evaporator
Condenser	1.5 oz.
Receiver Drier	1.5 oz.
Hose - Vapor	1.0 oz. per 10 foot
Hose – Liquid	1.0 oz. per 20 foot

- F. **Compressor Replacement** – To properly calculate the amount of oil required in the replacement compressor, it is necessary to pour the oil out of the old compressor into a clean container. Drain the oil out of the fill plug hole and then pour oil out of the suction and discharge ports while rotating the center shaft clockwise. Measure the total amount of oil removed from the old compressor. Add ½ oz. to the total measured to account for unrecoverable oil in the old compressor. This total is what is needed in the new compressor. New compressors come from Air Comm charged with 9 oz. (266.2 ml) of oil. This should be adjusted according to the amount of oil recovered from the old compressor and any other components being replaced. The receiver drier should always be replaced when the compressor is replaced or when the system has been open for an appreciable time, which accounts for another 1.5 oz. of oil that should be added.
- G. Below are two different examples of compressor (and receiver drier) replacement for illustration:

Example 1: Draining the old compressor recovered 2.0 oz. of oil. Adding 0.5 oz. of residual unrecoverable oil in the compressor gives 2.5 oz. The new receiver/drier requires an additional 1.5 oz., plus 1.5 oz. lost when the refrigerant was evacuated from the system. So the total oil needed in the replacement compressor for this case is 5.5 oz. Since the new compressor comes with 9 oz. of oil, remove the oil fill plug and pour out 3.5 oz. of oil.

Example 2: Evacuating the system recovers 2 oz. of oil. Draining the old compressor recovers 5 oz. of oil. Adding the ½ oz. of unrecoverable oil, plus 1.5 oz. for the new receiver drier gives a total of 9.0 oz. needed. The compressor is delivered with 9 oz. of oil. In this case, no additional oil is needed. If oil was needed, it could either be added to the compressor, or to the plumbing downstream of the compressor.

#### 4. SYSTEM LEAK CHECK

Identification and elimination of system fitting leaks is extremely important to ensure a trouble free operation of this system.

A system which contains a partial charge of refrigerant can be leak tested with the aid of an electronic leak detector, and be recharged without evacuating the system.

A new or empty system can be pressurized with nitrogen (70-80 psi) or R134a (50 psi) to conduct a leak survey. DO NOT USE COMPRESSED AIR. Compressed air will introduce moisture into the system, which will degrade the operation of the system.

The preferred method is to use an electronic leak detector in conjunction with a small charge of R134a refrigerant. All checks done in this manner should be conducted with the air conditioner off. Since the refrigerant is heavier than air, leaks are most likely to be detected on the underside of hoses and fittings. Refrigerant will collect in low areas and provide erroneous leak detections. A stream of compressed air from a nozzle may be useful in clearing the area just prior to conducting a leak test.

If the nitrogen method is used, it will be necessary to mix together a water-and-mild-soap solution. Each fitting or suspected leak area should be brushed with this soap solution and watched for evidence of bubbles formed by the escaping nitrogen.

If a leak is detected at an O-ring fitting; check to ensure proper torque has been applied to the fitting. If the system continues to leak, reclaim the system of refrigerant, and install a new O-ring. NOTE: be sure that the O-ring is lubricated with refrigerant oil prior to its installation.

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

**5. SUGGESTED EQUIPMENT REQUIRED FOR SERVICING**

Recovery / Recycling / Recharging Station

Any model manufactured to comply with specification SAE J2788

Electronic Leak Detector (R134a compatible)

(Example: Micro-Tech III, Robinair, Snap-on, or equivalent).

Manifold and gauge set (R134a compatible)

(Example: Robinair, Snap-on, or equivalent).

**6. CONSUMABLE MATERIALS**

A. Refrigerant:

This system is to be charged with Dupont, or equivalent HFC R134a refrigerant only.

B. Lubricant: - This system is to be serviced with Ultra PAG refrigerant oil.

C. O-rings:

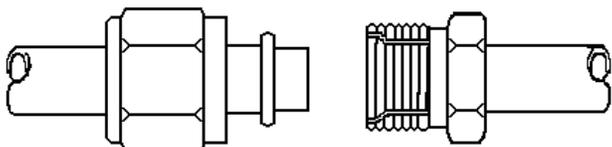
As this system is charged with R134a refrigerant, it must be fitted with Highly Saturated Nitriles (HSN) O-rings. This system incorporates two different O-ring fittings, TORQ LOK® and Insert. The HSN O-rings for the TORQ LOK® fittings are BLACK in color and the HSN O-ring for the Insert fittings are GREEN in color.



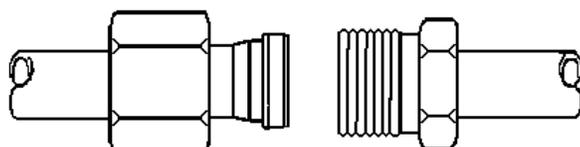
CHAPTER 7  
STANDARD PRACTICES INFORMATION

1. FITTING TORQUING PROCEDURES AND TORQUE VALUES

INSERT O-RING FITTINGS



TORQ LOK® FITTINGS



Apply a thin coating of refrigerant oil to O-ring and Female side of fitting.

Confirm there is no damage (nicks, dirt, etc.) on fittings.

Slide B-nut back away from the end of the tube so you can see the O-ring as you slide the fitting together.

Be careful not to pinch O-ring during assembly.

Engage the male end into the female fitting being careful to maintain alignment.

The male flange should seat fully against the female fitting without the O-ring being pinched.

It is important to hold the fitting together while sliding the B-nut forward and engaging the threads. Tighten the B-nut by hand and then torque as follows.

Tightening specifications

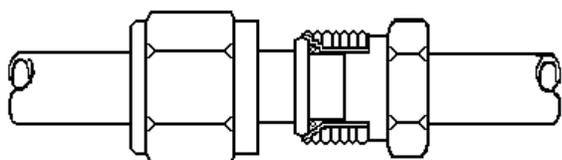
CAUTION: ALWAYS USE BACK UP WRENCH. EXCESSIVE TORQUE WILL DAMAGE THE JOINT, COMPROMISING THE INTEGRITY OF THE SEAL.

Insert O-Ring Fittings (regardless of size): Hand tighten, then turn an additional 60 deg. (one flat on the nut).

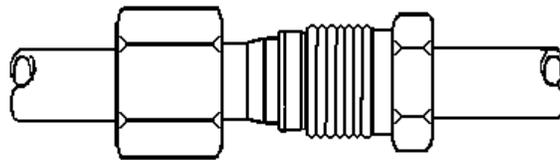
TORQ-LOK ® fittings (regardless of size): Hand tighten, then turn an additional 30 deg.

ALWAYS USE BACK UP WRENCH – DO NOT OVER TORQUE

INSERT O-RING FITTINGS



TORQ LOK® FITTINGS



Once the 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 the fittings have been checked and are found to be free of leaks, torque seal as appropriate.

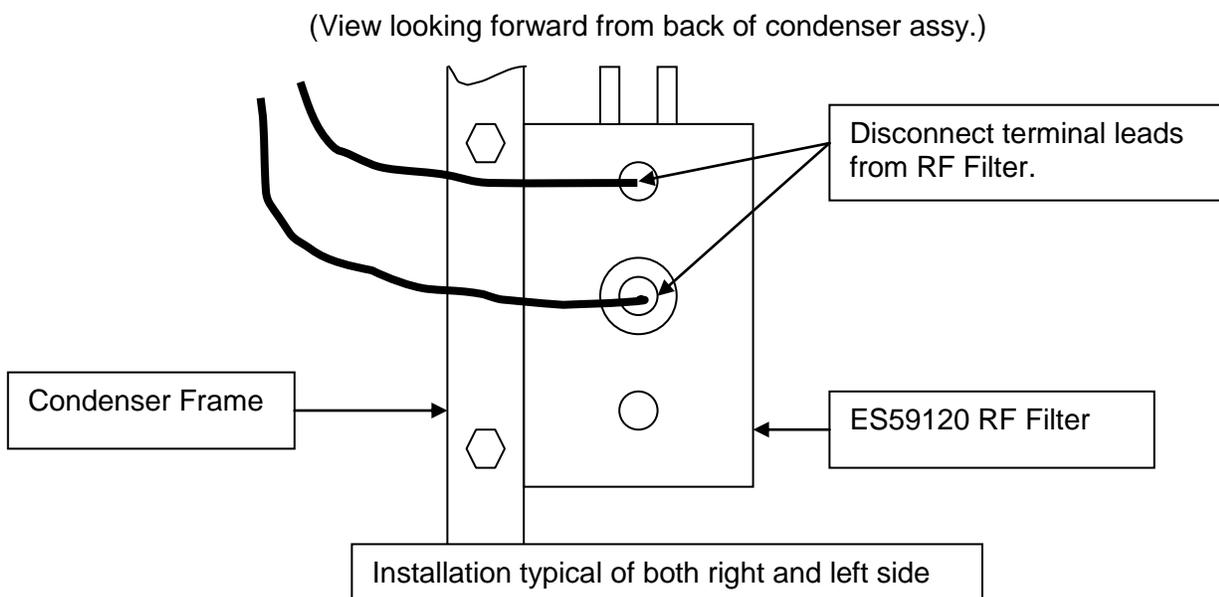
## 2. REMOVAL & REPLACEMENT OF THE CONDENSER BLOWER MOTOR & FAN ASSEMBLY

### REMOVAL

#### CAUTION

It is recommended that the battery and external power be disconnected before starting work.

- A. Remove the upper transmission pylon cowl to gain access to the air conditioner condenser assembly.
- B. Remove and retain the screws from the condenser access panel located on the upper rear section of the condenser housing. (This will provide the necessary access to remove the blower motor and fan assembly)
- C. Disconnect the terminal leads from the blower motors that attach to the ES59120 RF Filter. These are located on each side of the aft lower section of the condenser frame. These wires will need to be pushed (one at a time) through the grommet on the blower housing.



**Figure 6: Disconnect Terminal Leads from Motor**

- D. Cut the safety wire attached to the three (3) motor mounting bolts on the 412AC-7058-16 Vane Axial Blower.
- E. Remove and retain the motor mounting bolts and spacers holding the ES73131-X motor & fan assembly to the blower housing.

#### CAUTION

Be sure to support the blower fan & Motor assembly prior to removing the mounting bolts, this will prevent any damage to the stator vanes in-side the blower housing.

**CAUTION**

Do not attempt to remove the fan blade assembly from the motor. The fan blade is threaded to the motor armature shaft, and damage will occur if proper tooling is not available.

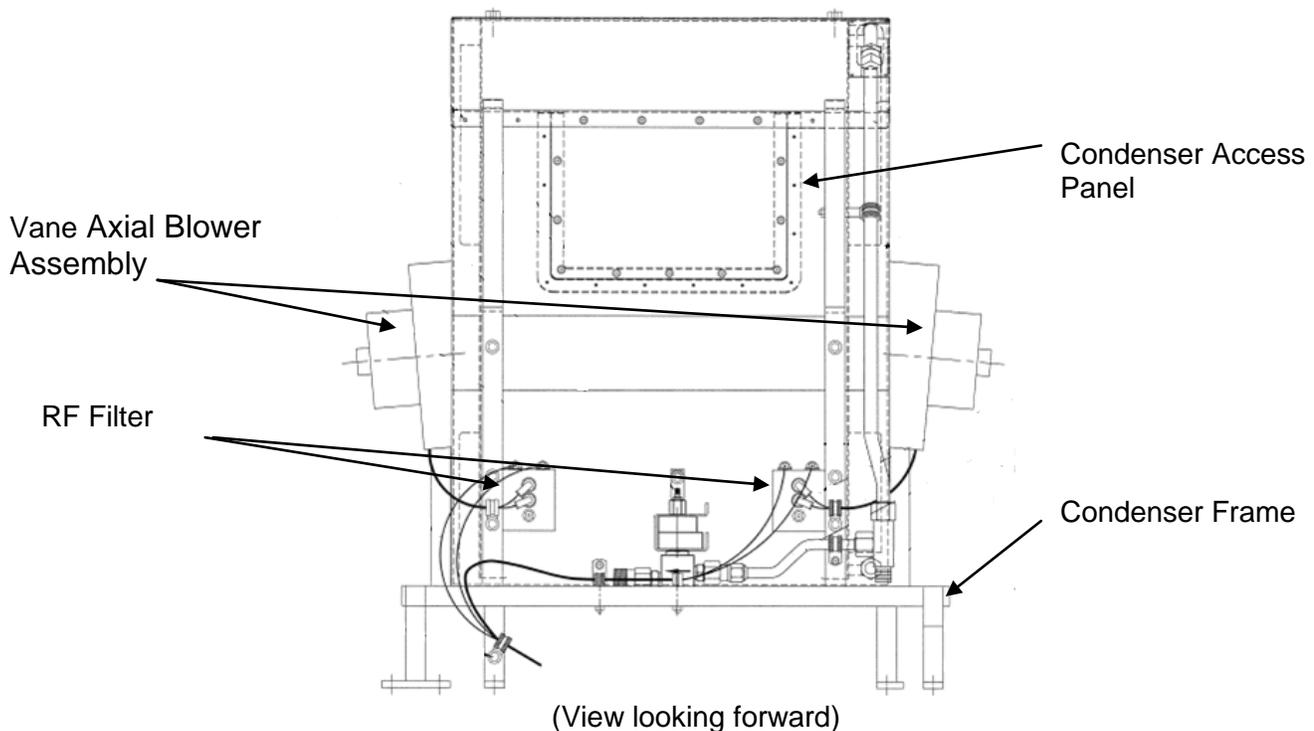
- F. Once the motor mounting bolts have been removed, the fan & motor can be removed as a complete assembly through the open condenser access panel in the rear of the condenser housing.

**CAUTION**

Care should be taken not to damage the aluminum fins inside the condenser housing when removing, or installing the blower fan & motor assembly.

**NOTE**

If the fins are bent or dented they must be combed out using a "Fin Comb Tool."



**Figure 7: Condenser Access Panel**

- G. Carefully package the ES73131 Fan & Motor assembly after its removal for shipping.

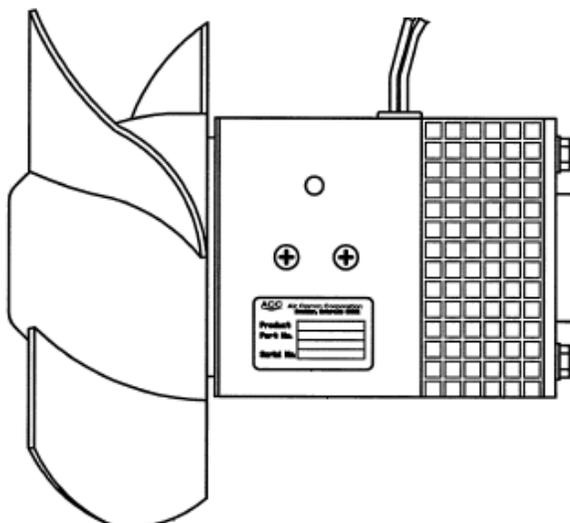


Figure 8: ES73131 Fan & Motor Assembly

**INSTALLATION / REPLACEMENT**

- A. Use the torque chart below for the re-installation of the blower mounting bolts. Torque each bolt in succession around the blower housing until all three torques have been achieved.
- B. Unpack the ES73131 Fan & Motor assembly to ready for installation.

**CAUTION**

Care should be taken not to damage the aluminum fins inside the condenser housing when removing, or installing the blower fan & motor assembly.

**NOTE**

If the fins are bent or dented they must be combed out using a “Fin Comb Tool.”

- C. Place the fan & motor assembly through the open condenser access panel in the rear of the condenser housing.
- D. Ensure the blower fan & motor assembly are in the proper location and position and hold in place. This will require supporting the blower fan and motor.
- E. Reinstall the three (3) motor mounting bolts and three (3) spacers to hold the ES73131-X motor & fan assembly to the blower housing.
- F. Attach new safety wire to the three (3) mounting bolts on the 412AC-7058-16 Vane Axial Blower.
- G. Push the two (2) terminal leads through the grommets on the blower housing.
- H. Connect the terminal leads to the blower motors that attach to the ES59120 RF Filter.
- I. Reinstall the screws to the condenser access panel located on the upper rear section of the condenser housing.

- J. Reinstall the upper transmission pylon cowling.

**Torque Chart**

Blower Part Number	Torque Blower Mounting Bolts as Follows		
	1 <sup>st</sup> Torque	2 <sup>nd</sup> Torque	3 <sup>rd</sup> Torque
412AC-7058-16 (ES73131)	30 in/lbs.	45 in/lbs.	60 in/lbs

(Troubleshooting chart for ES73131 blower assembly is located in Chapter 7 of this manual.)

\* Contact the Air Comm Corporation Service Department for current price and availability for replacement of the ES73131 fan and motor assembly.

**3. REMOVAL, REPLACEMENT & ADJUSTMENT OF THE COMPRESSOR DRIVE BELTS**

**REMOVAL**

- A. It is necessary to remove the aft transmission cowling to gain access to the Compressor Drive Belts for replacement and adjustment procedures.
- B. Cut safety wire on the Compressor Belt Tensioning link and the Belt Tensioning Bolt, and loosen and retain their respective Jam Nut(s).

**CAUTION**

Before attempting to adjust the lower drive belt tension, ensure that the speed reducer mount attaching bolts have been loosened.

**NOTE**

It is not necessary to loosen the speed reducer mounting bolts when replacing or adjusting the upper drive belt tension only.

- C. Loosen the tension on the Compressor Belt Tension link, and remove upper drive belt. (See Figure 9 below)

**NOTE**

To remove or replace the lower drive belt it is necessary to disconnect the forward end of the main transmission drive shaft coupling.  
(See BHT Service Manual for Instructions)

**NOTE**

It is acceptable to place balance weights on the aft side of the coupling bolts.

- D. Turning the Belt Tensioning Bolt Clock-wise (ensure that the speed reducer mounting bolts are loose) will loosen the belt tension, and allow the lower drive belt to be removed.

## **INSTALLATION / REPLACEMENT**

### **CAUTION**

Before attempting to adjust the lower drive belt tension, ensure that the speed reducer mount attaching bolts have been loosened.

### **NOTE**

To replace the lower drive belt it is necessary to disconnect the forward end of the main transmission drive shaft coupling.  
(See BHT Service Manual for Instructions)

- A. Replace the lower drive belt and turn the belt tensioning bolt counter clockwise to tighten (ensure that the speed reducer mounting bolts are tightened as well).
- B. Install the upper drive belt.
- C. Tighten the tension on the compressor belt tension link.
- D. Reinstall the belt tensioning bolt and jam nut(s).
- E. Install safety wire on the belt tensioning link and belt tensioning bolt.
- F. Re-torque the speed reducer mounting bolts to 95-110 inch lbs.
- G. Re-torque the compressor mounting bolts to 95-110 inch lbs.
- H. Replace the aft transmission cowl when installation and adjustments are completed.

## **ADJUSTMENT**

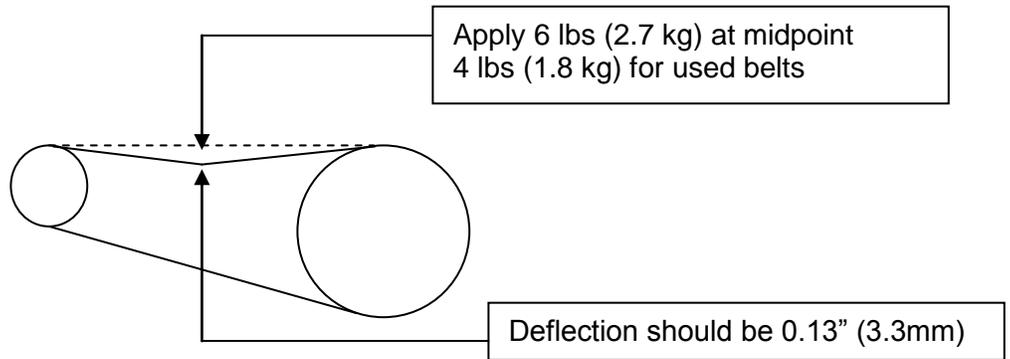
### **NOTE**

Proper belt tension is important to ensure a long belt service life and to avoid excessive loads on the compressor, and speed reducer bearing assemblies.

### **NOTE**

When adjusting or replacing the drive belts, tension the lower belt first.

- A. The correct belt tension for the upper and lower 3/8" (10mm) belt is 61 lbs. (24.6 kg.)
- B. This can be achieved with the aid of a belt tensioning tool (this is the preferred method of obtaining proper belt tensioning).
- C. An alternate method is to observe a .13" (3.3 mm) belt deflection when 6 lbs (2.7 kg.) for new belts and 4 lbs. (1.8 kg.) for used belts of pressure is applied to the midpoint of the belt span.



**NOTE**

The belt tension should be checked, and re-adjusted, if necessary after the first two hours of operation for a newly installed belt.

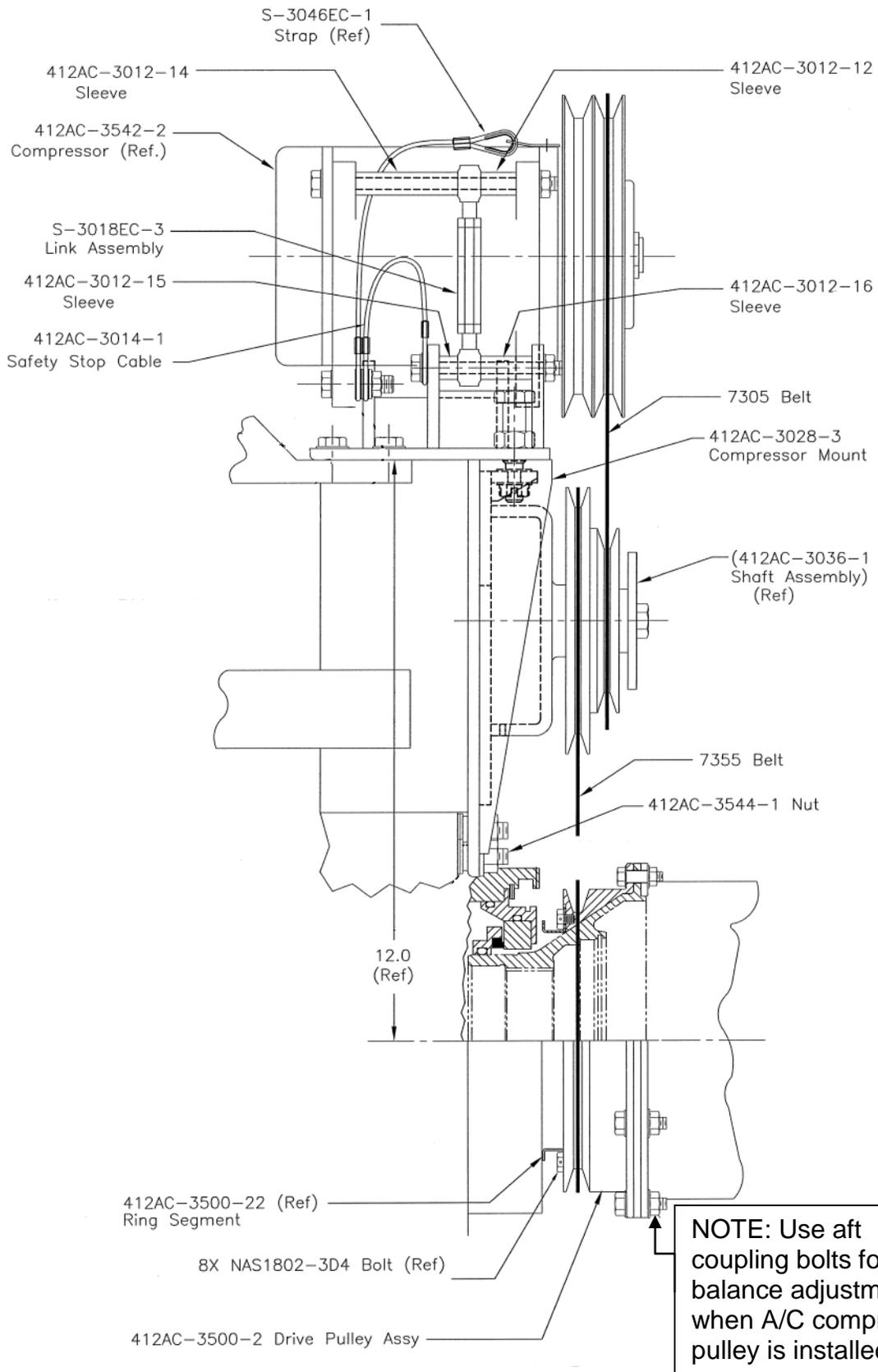
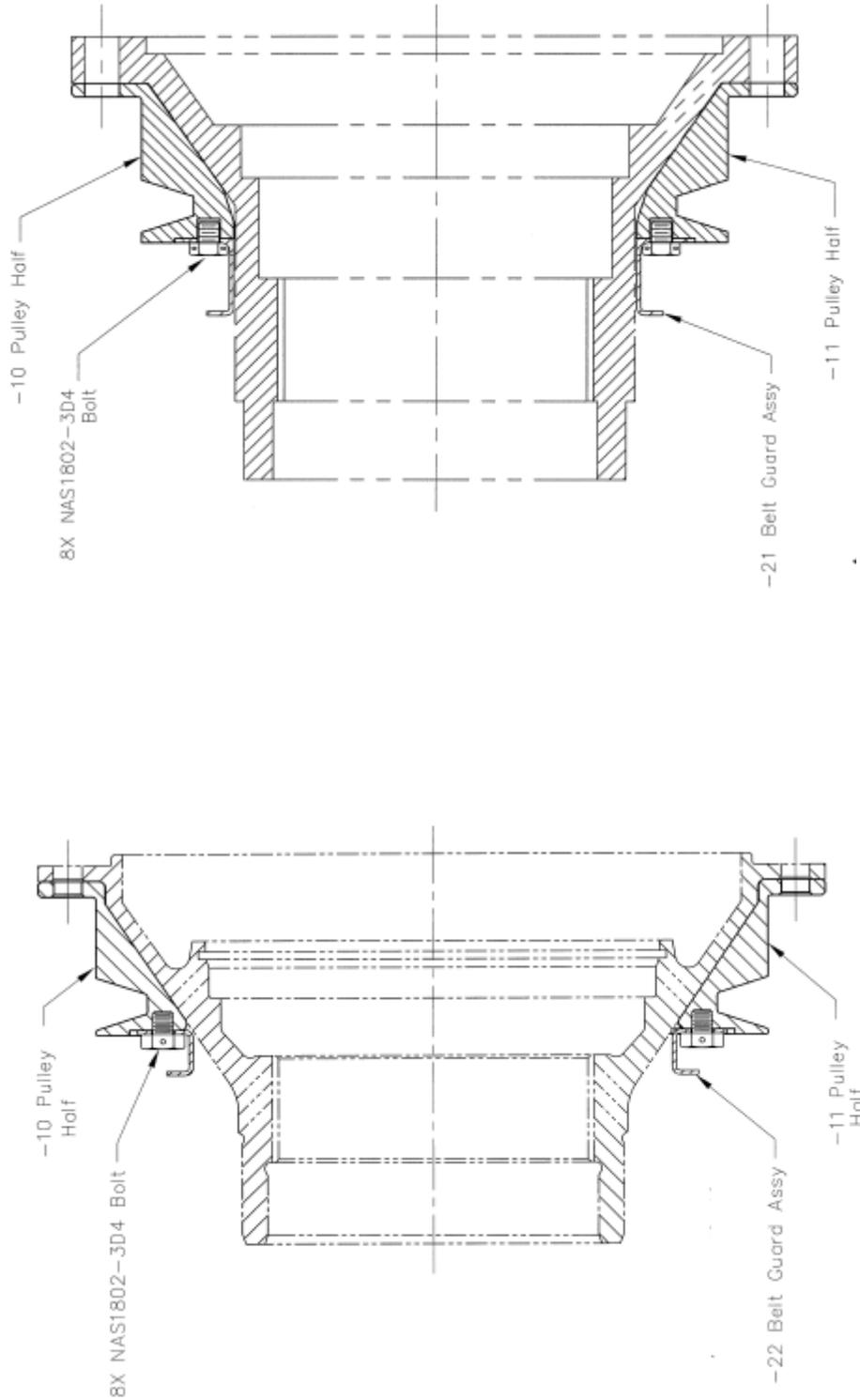


Figure 9: COMPRESSOR DRIVE ILLUSTRATION

(Removal & Replacement of the compressor drive belt guards)



412EP & 412HP Drive Pulley

412 & 412SP Drive Pulley

412 -3500 & 412-3504 Drive Pulley Belt Guard Installation

**NOTE:** Use aft coupling bolts for shaft balance adjustment

**Figure 10: COMPRESSOR DRIVE ILLUSTRATION**

(Removal & Replacement of the speed reducer pulley)

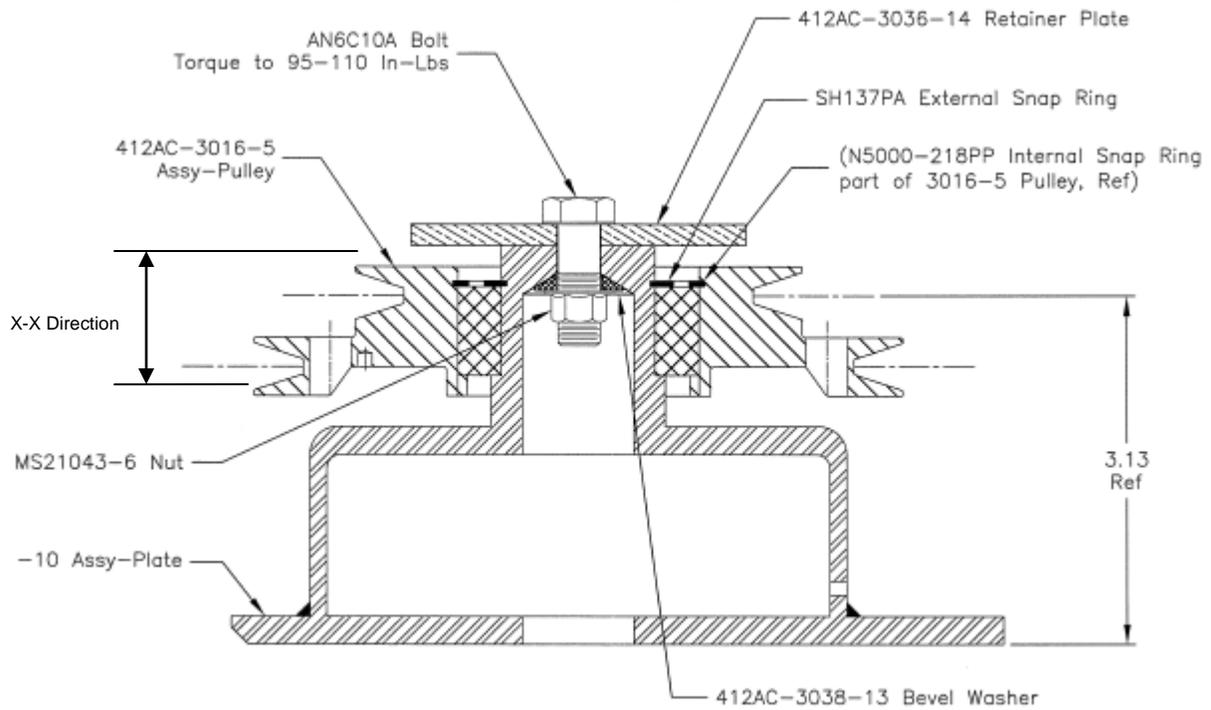
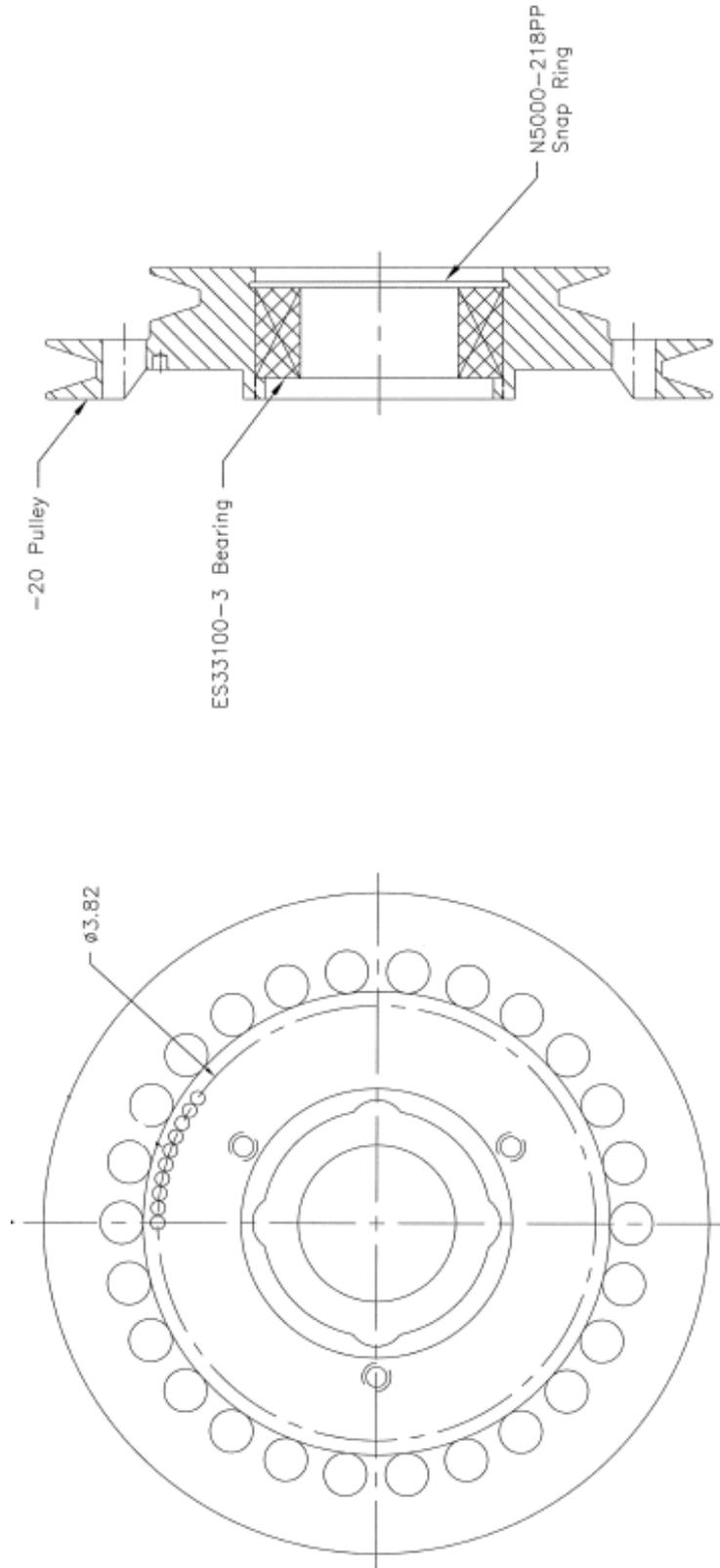


Figure 11: COMPRESSOR DRIVE ILLUSTRATION

(Removal & replacement of the speed reducer bearing)



Speed Reducer Pulley and Bearing Assembly

Figure 12: COMPRESSOR DRIVE ILLUSTRATION

**4. REMOVAL, INSTALLATION / REPLACEMENT OF AIR CONDITIONER COMPRESSOR ASSEMBLY**

**REMOVAL**

- A. See Removal, Replacement, and Adjustment of Compressor Drive Belt (pages 27-30) prior to the removal of the air conditioner compressor assembly, following Steps A-D under the Removal section.
- B. It will be necessary to evacuate (discharge) the refrigerant from the system to remove and replace the air conditioner compressor. Instructions for servicing the system are found in Chapter 6 Servicing.

**CAUTION**

Refrigeration servicing should be performed by qualified personnel only.

- C. Disconnect the refrigerant hoses from the suction and discharge ports located on the top of the compressor housing.
- D. Remove and retain the attaching hardware from the top of the belt tensioning link and the compressor mount assembly.
- E. Remove and retain the two (2) mounting bolts that attach the compressor body to the top of the compressor mount, and remove compressor assembly.

**INSTALLATION / REPLACEMENT**

- A. Install the compressor assembly to the top of the compressor mount.
- B. Reinstall the two (2) mounting bolts that attach the compressor body to the top of the compressor mount.
- C. Re-install the belt tension link attaching hardware to the compressor mount and torque to 95-110 inch lbs.
- D. Adjust the belt tension per the procedure on Page 27.
- E. Replace the O-rings on the refrigerant hoses, and re-connect the hoses to the compressor housing. Torque the #10 hose fitting to 50-55 inch lbs, and torque the #8 hose fitting to 40-45 inch lbs.

**CAUTION**

Refrigeration servicing should be performed by qualified personnel only.

- F. It will be necessary to refill the refrigerant in the system to replace the air conditioner compressor. Instructions for servicing the system are found in chapter 6 Servicing.
- G. See Removal, Replacement, and Adjustment of Compressor Drive Belt (page 27-30), prior to the replacement of the air conditioner compressor assembly, following Steps A-H under the Replacement section.
- H. Torque all attaching hardware to 95-110 inch lbs.
- I. Recharge the refrigerant per the servicing instructions on Page 14.

**CAUTION**

Refrigeration servicing should be performed by qualified personnel only.

**NOTE**

The use of an electronic leak detector should be used any time a component is replaced or the system has been opened, to ensure trouble free operation of the air conditioner system.

**5. REMOVAL, INSTALLATION / REPLACEMENT OF THE AIR CONDITIONER COMPRESSOR DRIVE PULLEY FROM THE MAIN TRANSMISSION DRIVE SHAFT**

**REMOVAL**

- A. See Removal, Replacement & Adjustment of Compressor Drive Belt (Page 27 and 28) prior to the removal of the air conditioner drive shaft pulley.
- B. It should be noted that the air conditioner drive pulley is a two-piece assembly, and the main transmission drive shaft need not be removed. It is necessary however to remove the attaching hardware from the drive shaft assembly that attaches it to the transmission input quill, as well as the hardware that attaches the split ring to the drive pulley for its removal.
- C. Once the split ring has been removed from the pulley assembly, the pulley halves may be separated, and removed.

**INSTALLATION / REPLACEMENT**

- A. Attach the pulley halves.
- B. Secure the pulley halves using a split ring. This makes up the pulley assembly.
- C. Install the air conditioner drive pulley assembly by reinstalling the attachment hardware to the drive shaft assembly that attaches it to the transmission input quill.
- D. Use the BHT service manual for torquing the attaching hardware.
- E. Re-install and adjust the drive belt per the instructions given on page 27 and 28.

**6. REMOVAL, INSTALLATION / REPLACEMENT OF THE FORWARD EVAPORATOR(S) ASSEMBLY**

**REMOVAL**

- A. It will be necessary to evacuate (discharge) the refrigerant from the system to remove or replace the forward evaporator assembly(s). Instructions for servicing the system are found in Chapter 5 Servicing.

**CAUTION**

Refrigerant servicing should be performed by qualified personnel only.

- B. Disconnect the refrigerant lines that attach closest to the evaporator assembly(s).

**CAUTION**

Always use a backup wrench when removing or installing refrigerant line fittings.

- C. Disconnect the ducting that attaches the forward evaporator to the forward blower assemblies.
- D. Remove and retain the two (2) retaining nuts on the inboard side of the evaporator assembly, and remove the evaporator assembly.

**INSTALLATION / REPLACEMENT**

- A. Install the forward evaporator assembly and reinstall the two (2) retaining nuts on the inboard side of the assembly.

- B. Reconnect the ducting that attaches the forward evaporator to the forward blower assemblies.

**CAUTION**

Refrigerant servicing should be performed by qualified personnel only.  
(Removal & Replacement of the forward evaporator(s) assembly continued)

**CAUTION**

Always use a backup wrench when removing or installing refrigerant line fittings.

- C. Reconnect the refrigerant lines that attach closest to the evaporator assembly.
- D. Torque the refrigerant line connections to 30-35 inch lbs for the #6 fitting, and 40-45 inch lbs for the #8 fitting, and replace all O-rings.

**CAUTION**

Always use back up wrench when removing or installing refrigerant line fittings.

- E. Recharge refrigerant per the servicing instructions on Page 15, steps A-I.

**NOTE**

The use of an electronic leak detector should be used any time a component is replaced or the system has been opened, to ensure trouble free operation of the air conditioner system.

**7. REMOVAL, INSTALLATION / REPLACEMENT OF THE AFT EVAPORATOR ASSEMBLY**

**REMOVAL**

- A. Remove the forward transmission cowling to gain access to the Aft Evaporator assembly.
- B. It will be necessary to evacuate (discharge) the refrigerant from the system to remove or replace the aft evaporator assembly. Instructions for servicing the system are found in Chapter 6 Servicing.

**CAUTION**

Refrigerant servicing should be performed by qualified personnel only.

- C. Disconnect the refrigerant lines that connect to the expansion valve located on the right hand side of the evaporator assembly. Note it is not necessary or advised to remove the expansion valve from the aft evaporator, unless absolutely necessary.

**CAUTION**

Always use a backup wrench when removing or installing refrigerant line fittings.

- D. Remove and retain the five (5) mounting bolts that attach the aft evaporator assembly to the cabin roof.
- E. Disconnect the wires to the aft evaporator blower motors on the aft side of the evaporator assembly.
- F. Disconnect the drain tube from the bottom aft section of the aft evaporator housing, and remove the aft evaporator assembly by lifting the evaporator housing up.

**INSTALLATION / REPLACEMENT**

- A. Install the aft evaporator assembly in the evaporator housing.
- B. Reconnect the drain tube to the bottom of the aft section of the aft evaporator housing.
- C. Reconnect the wires to the aft evaporator blower motors on the aft side of the evaporator assembly.
- D. Reinstall the five (5) mounting bolts that attach the aft evaporator assembly to the cabin roof.

**CAUTION**

Refrigerant servicing should be performed by qualified personnel only.

**CAUTION**

Always use a backup wrench when removing or installing refrigerant line fittings.

- E. Reconnect the refrigerant lines that connect to the expansion valve located on the right hand side of the evaporator assembly.

**NOTE:**

The expansion valve should not have been removed from the aft evaporator.

- F. Torque all attaching hardware to 50-70 inch lbs, replace all O-rings, and torque the refrigerant fittings per standard practices Page 23.
- G. Recharge the refrigerant per the service instructions on Page 14.
- H. Reinstall the forward transmission cowling.

**8. REMOVAL, INSTALLATION / REPLACEMENT OF THE AIR CONDITIONER CONDENSER ASSEMBLY**

**REMOVAL**

- A. Remove the forward transmission cowling to gain access to the air conditioner condenser assembly.
- B. It will be necessary to evacuate (discharge) the refrigerant from the system to remove or replace the condenser assembly. Instructions for servicing the system are found in Chapter 6 Servicing.

**CAUTION**

Refrigerant servicing should be performed by qualified personnel only.

- C. Disconnect the electrical connections to the condenser blower motor (See removal of condenser blower motor & fan assembly Page 24.)
- D. Disconnect the refrigerant lines that connect closest to the condenser assembly.

**CAUTION**

Always use a backup wrench when removing or installing refrigerant line fittings.

- E. Remove and retain the eight (8) mounting bolts from the condenser assembly support legs and remove the condenser assembly.

**INSTALLATION / REPLACEMENT**

- A. Install the condenser assembly.
- B. Reinstall the eight (8) mounting bolts in the condenser assembly support legs.

**CAUTION**

Always use a backup wrench when removing or installing refrigerant lines.

**CAUTION**

Refrigerant servicing should be performed by qualified personnel only.

- C. Reinstall the refrigerant lines that connect closest to the condenser assembly.
- D. Reconnect the electrical connections to the condenser blower motor (See removal of condenser blower motor & fan assembly Page 24.)
- E. Torque all attaching hardware to 50-70 inch lbs. Torque the refrigerant line connections to 30-35 inch lbs for #6 fitting, and 40-45 inch lbs for #8 fittings, and replace all O-rings.
- F. Recharge refrigerant per the servicing instructions on Page 14.
- G. Reinstall the forward transmission cowling.

**NOTE**

The use of an electronic leak detector should be used any time a component is replaced or the system has been opened, to ensure trouble free operation of the air conditioner system.

**9. REMOVAL, INSTALLATION / REPLACEMENT OF THE RECEIVER DRIER BOTTLE**

**REMOVAL**

- A. Remove the forward transmission cowling to gain access to the receiver drier bottle, which is located on the forward side of the right hand condenser support leg.
- B. It will be necessary to evacuate (discharge) the refrigerant from the system to remove or replace the receiver drier bottle. Instructions for servicing the system are found in Chapter 6 Servicing.

**CAUTION**

Refrigerant servicing should be performed by qualified personnel only.

**CAUTION**

Always use a backup wrench when removing or installing refrigerant line fittings.

- C. Disconnect refrigerant lines from both sides of the receiver drier.
- D. Loosen the retaining clamp holding the receiver drier bottle to the support bracket.
- E. Remove the receiver drier bottle.

**INSTALLATION / REPLACEMENT**

**NOTE**

Never reuse a receiver drier bottle, and keep new receiver drier bottles capped until just prior to their installation.

- A. Install the receiver drier bottle.
- B. Tighten the retaining clamp holding the receiver drier bottle to the support bracket.

**CAUTION**

Refrigerant servicing should be performed by qualified personnel only.

**CAUTION**

Always use a backup wrench when removing or installing refrigerant line fittings.

**CAUTION**

Observe refrigerant flow arrow on the drier bottle for proper orientation.

- C. Reconnect the refrigerant lines to both sides of the drier bottle.
- D. Replace all O-rings and torque the refrigerant line connections to 30-35 inch lbs.
- E. Recharge refrigerant per the servicing instructions on Page 15.
- F. Reinstall the forward transmission cowling.

**10. REMOVAL, INSTALLATION / REPLACEMENT OF HI/LO PRESSURE SWITCH**

**REMOVAL**

- A. Remove the forward transmission cowling to gain access to the Hi/Lo pressure switch, which is located on top of the receiver drier bottle on the forward right hand side of the condenser assembly.
- B. It will not be necessary to evacuate (discharge) the refrigerant from the system to remove or replace the Hi/Lo pressure switch from the receiver drier bottle.
- C. Disconnect electrical connectors from the top of the Hi/Lo pressure switch.
- D. Using a wrench to hold the Schrader valve in place, unscrew the Hi/Lo switch from the top of the receiver drier bottle, and remove switch.

**INSTALLATION / REPLACEMENT**

**NOTE**

Use the flats provided on the top of the switch body to tighten, do not attempt to tighten the pressure switch by hand.

- A. Install the Hi/Lo pressure switch on top of the receiver drier bottle and screw in place.
- B. Reconnect electrical connectors on the top of the Hi/Lo pressure switch.
- C. Reinstall the forward transmission cowling.

**11. REMOVAL, INSTALLATION / REPLACEMENT OF THE BY-PASS VALVE ASSEMBLY**

**REMOVAL**

- A. Remove the forward transmission cowling to gain access to the by-pass valve assembly, which is located on the aft side of the condenser assembly.
- B. It will be necessary to evacuate (discharge) the refrigerant from the system to remove or replace the by-pass valve. Instructions for servicing the system are found in Chapter 6 Servicing.

**CAUTION**

Refrigerant servicing should be performed by qualified personnel only.

- C. Disconnect the electrical connector to the by-pass valve assembly.
- D. Disconnect the refrigerant lines from both sides of the by-pass valve assembly.

**CAUTION**

Always use a backup wrench when removing or installing refrigerant line fittings.

- E. Remove the by-pass valve assembly.

**INSTALLATION / REPLACEMENT**

- A. Install the by-pass valve assembly.

**CAUTION**

Always use a backup wrench when removing or installing refrigerant line fittings.

- B. Reconnect electrical connectors on the top of the bypass valve assembly.

**CAUTION**

Refrigerant servicing should be performed by qualified personnel only.

- C. Replace all O-rings.
- D. Recharge the system per the servicing instructions on Page 15.
- E. Reinstall the forward transmission cowling.

**AIR CONDITIONER SERVICE MANUAL 412AC-210M  
CHAPTER 8**

**TROUBLESHOOTING**

**1. SYSTEM TROUBLESHOOTING**

Prior to troubleshooting a defective system, it is advisable to conduct a visual inspection for general condition, and obvious signs of damage or failure.

The following matrix lists the easiest checks, and the most likely problems.

Problem	Probable Cause	Solution
System not Cooling (Evaporator blowers still operating)	a. System is low or empty of refrigerant.	a. Evacuate the system, determine the origin of the refrigerant leak, and re-charge the system as prescribed in chapter 6.
	b. Moisture or air in the system.	b. Evacuate the system, Replace the receiver / drier, and place the system under a vacuum for a minimum of 30 minutes before recharging the system. <sup>1</sup>
	c. Compressor	c. If the compressor has failed, it must be replaced. <sup>1</sup>
	d. Compressor drive belt	d. If the compressor drive belt(s) have failed they will need to be replaced. Replace and adjust compressor drive belt(s) as prescribed in chapter 7. <sup>1</sup>
	e. By-pass valve	e. Check to ensure the temperature control knob on the A/C control panel in the cockpit is in the full cold position, and the temperature control circuit breaker has not tripped. If the valve remains open (by-passing refrigerant) the valve will need replacement. <sup>1</sup>
	f. Condenser blower motor(s) & fan assemblies (Part No. ES73131)	f. Check to ensure the condenser blower motor(s) and fan assemblies are receiving power, and the circuit breakers have not tripped. If the blowers still do not function they may have failed internally and must be replaced as shown in chapter 7. <sup>1</sup>
System not cooling (Evaporator blowers not operating)	g. Air conditioner control circuit breaker tripped.	g. Reset circuit breaker, if breaker will not reset, check for short in circuit.
	h. Forward or Aft evaporator blower circuit breaker tripped.	h. Reset circuit breaker, if breaker will not reset, check for short in circuit.

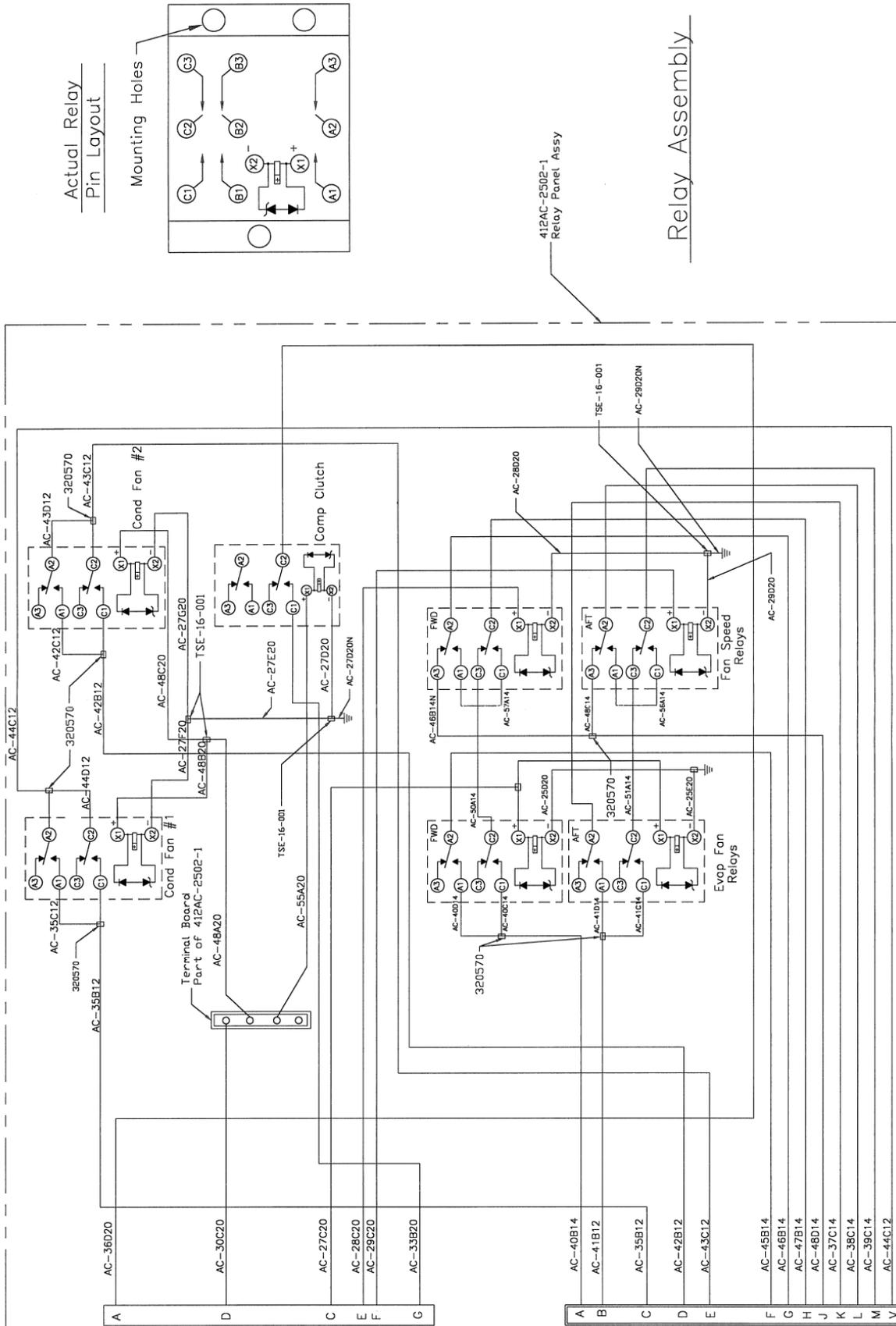
## AIR CONDITIONER SERVICE MANUAL 412AC-210M

(System troubleshooting continued)

Problem	Probable Cause	Solution
System not cooling (Evaporator blowers not operating)	i. Forward and aft evaporator blower motor(s)	i. Check for power to the motor(s), and for the free movement of the blower wheel. If the motor shaft does not turn smoothly the motor must be replaced. <sup>1</sup>
Loss of cooling limited to one evaporator.	j. Expansion valve malfunction.	j. If cooling is lost in only one of the evaporators, and the blowers continue to function, is most likely a blockage at the expansion valve orifice. This is most often caused by moisture in the system forming ice as the refrigerant passes through the valve. Evacuating the system and changing the receiver drier should cure this problem. If this problem occurs at only one evaporator, the problem could be caused by dirt or other contaminant blocking the valve. In extreme cases of blockage the expansion valve may have to be replaced. <sup>1</sup>
Water in chin bubble area of forward evaporators	k. Leak in evaporator or evaporator drainage system.	k. If water is noted in the chin bubble area near the forward evaporators. This is normally caused by a loose, cracked, plugged, or disconnected drain line.
Water (Condensate) in the area of the aft evaporator.	l. Aft evaporator drainage system.	l. If water is noted coming from the main cabin outlets, or the aft evaporator return air duct, the drain line is most likely plugged. A small amount of compressed air on the end of the drain line will usually dislodge any obstruction.
Ground Cooling Unit Non-operational	m. Ground Cooling Compressor Drive Motor is receiving 28 Volts DC & Ground Cooling Compressor Clutch is engaging.	m. No power At Ground Power Plug. 250 Amp Fuse has blown.

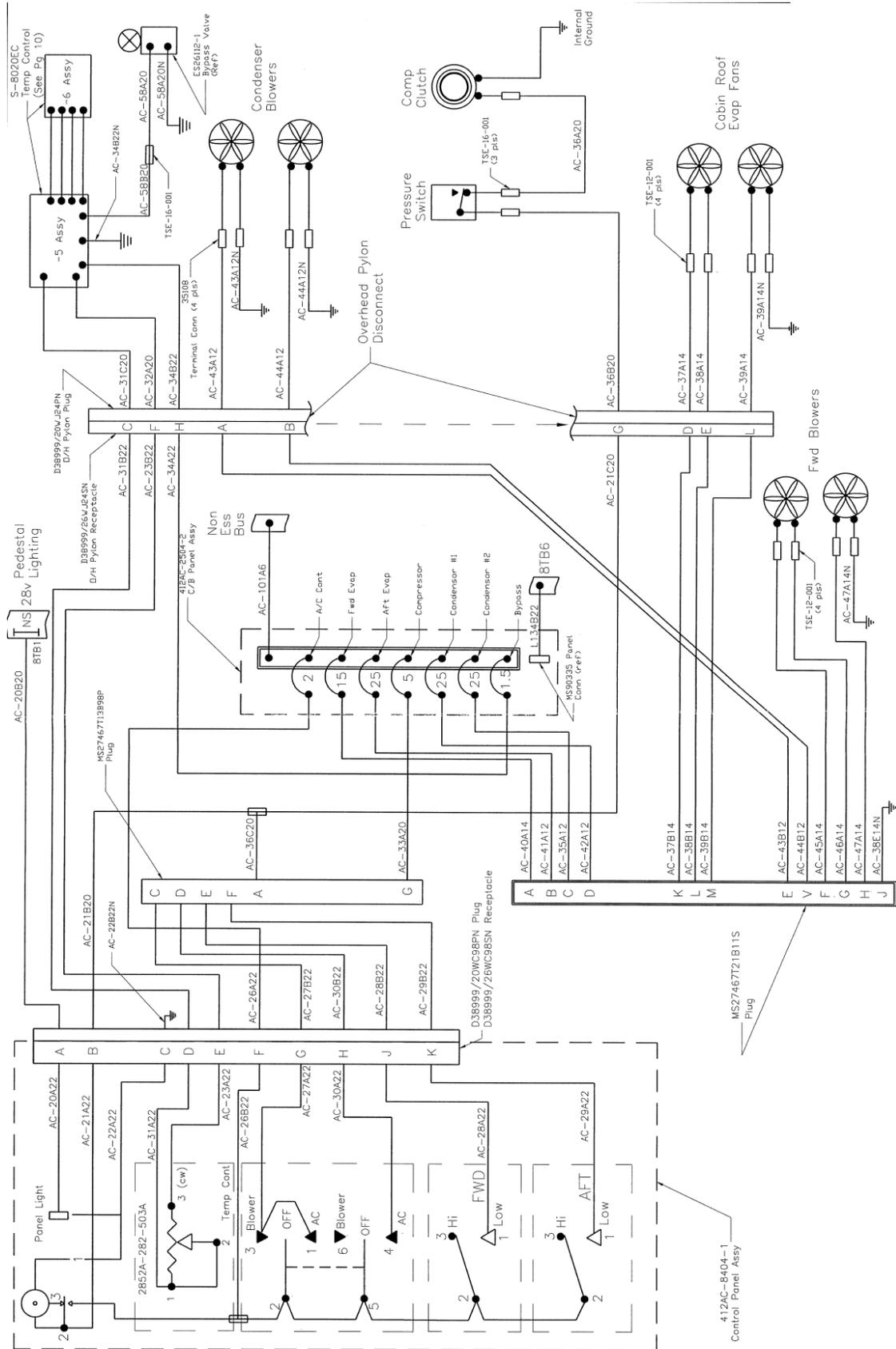
(1 Contact Air Comm Corporation Service Department for current pricing and availability of replacement components and parts).

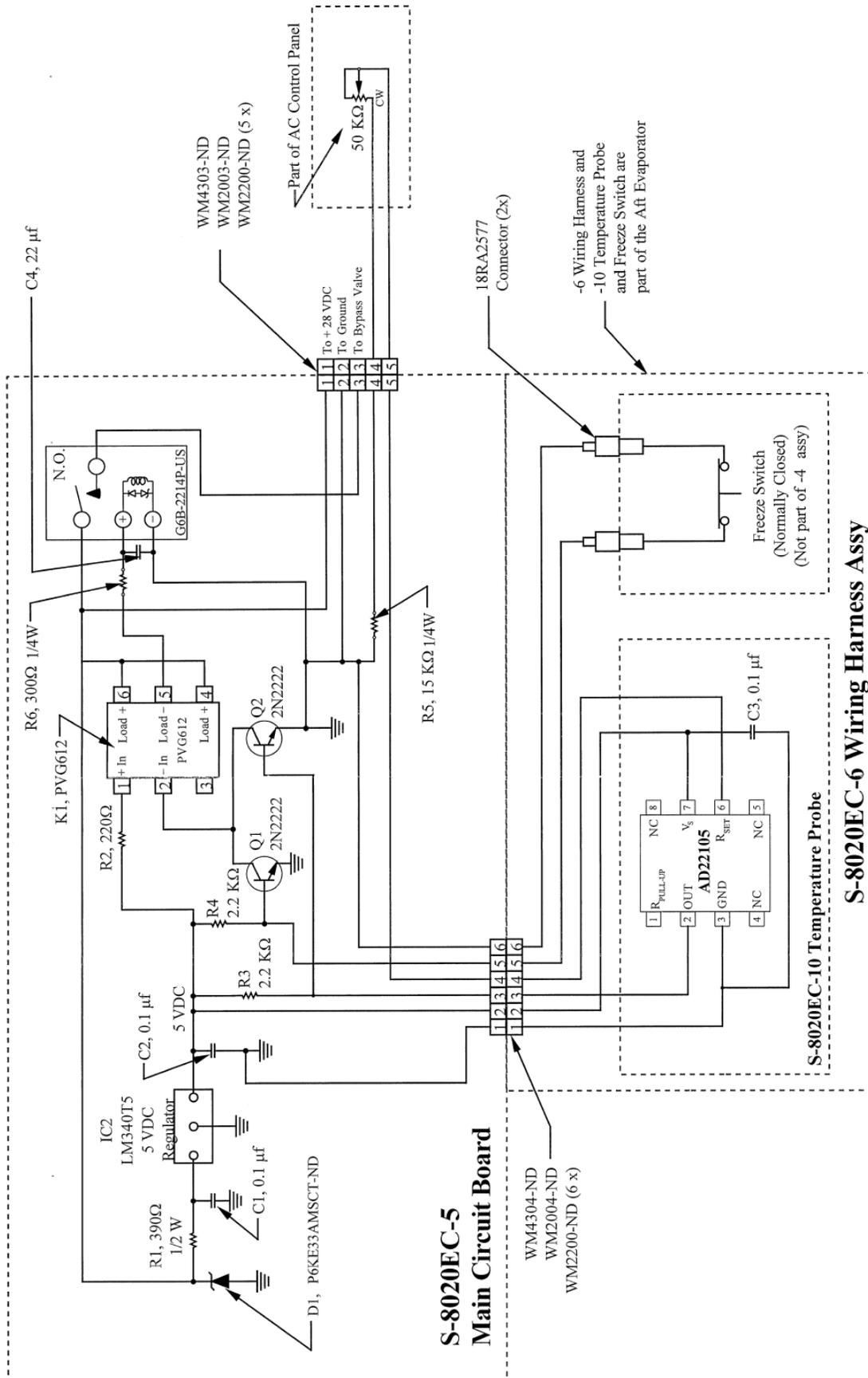
412AC-810 ELECTRICAL SCHEMATIC



# AIR CONDITIONER SERVICE MANUAL 412AC-210M

(412AC-810 ELECTRICAL SCHEMATIC CONTINUED)







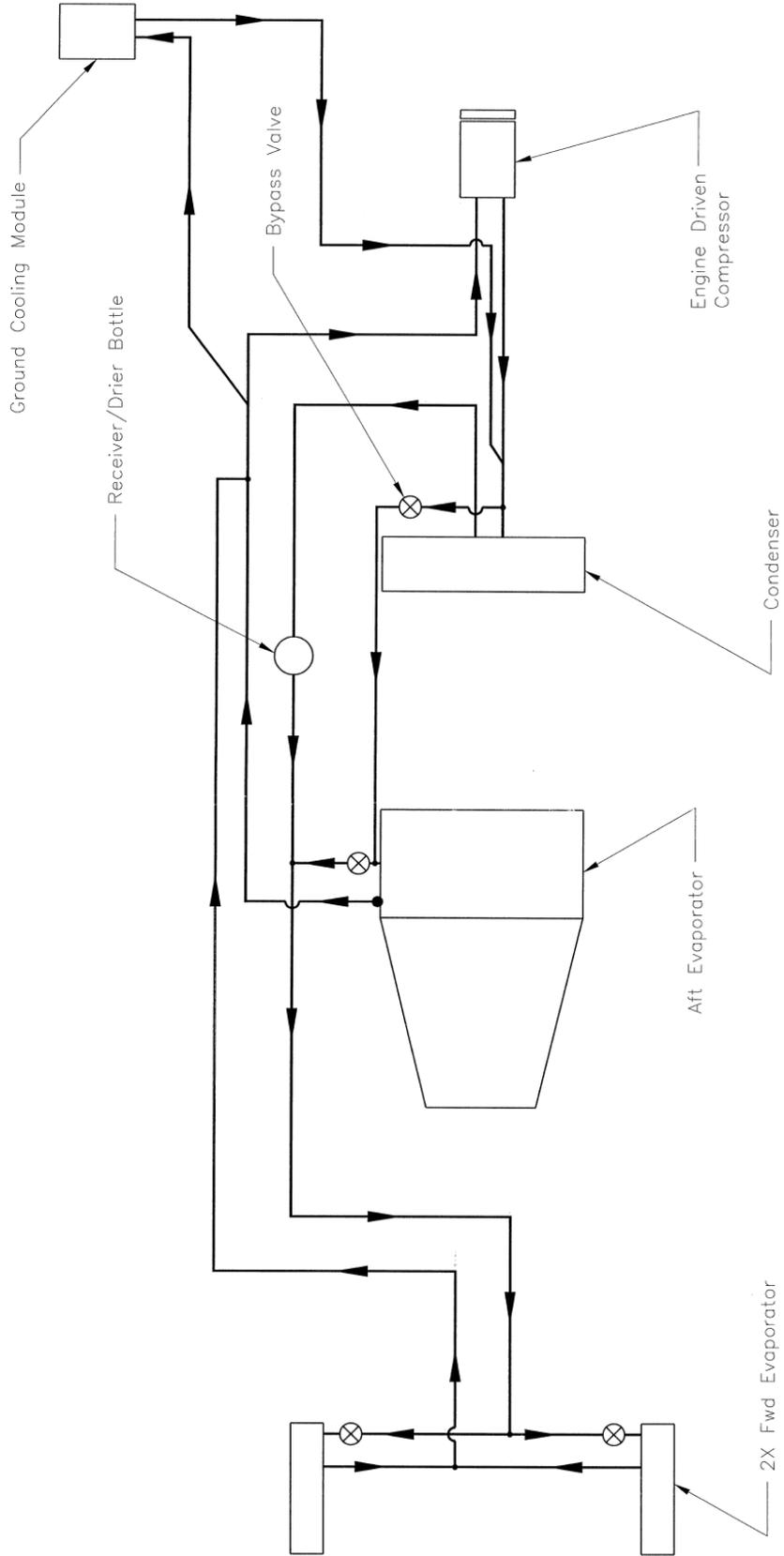
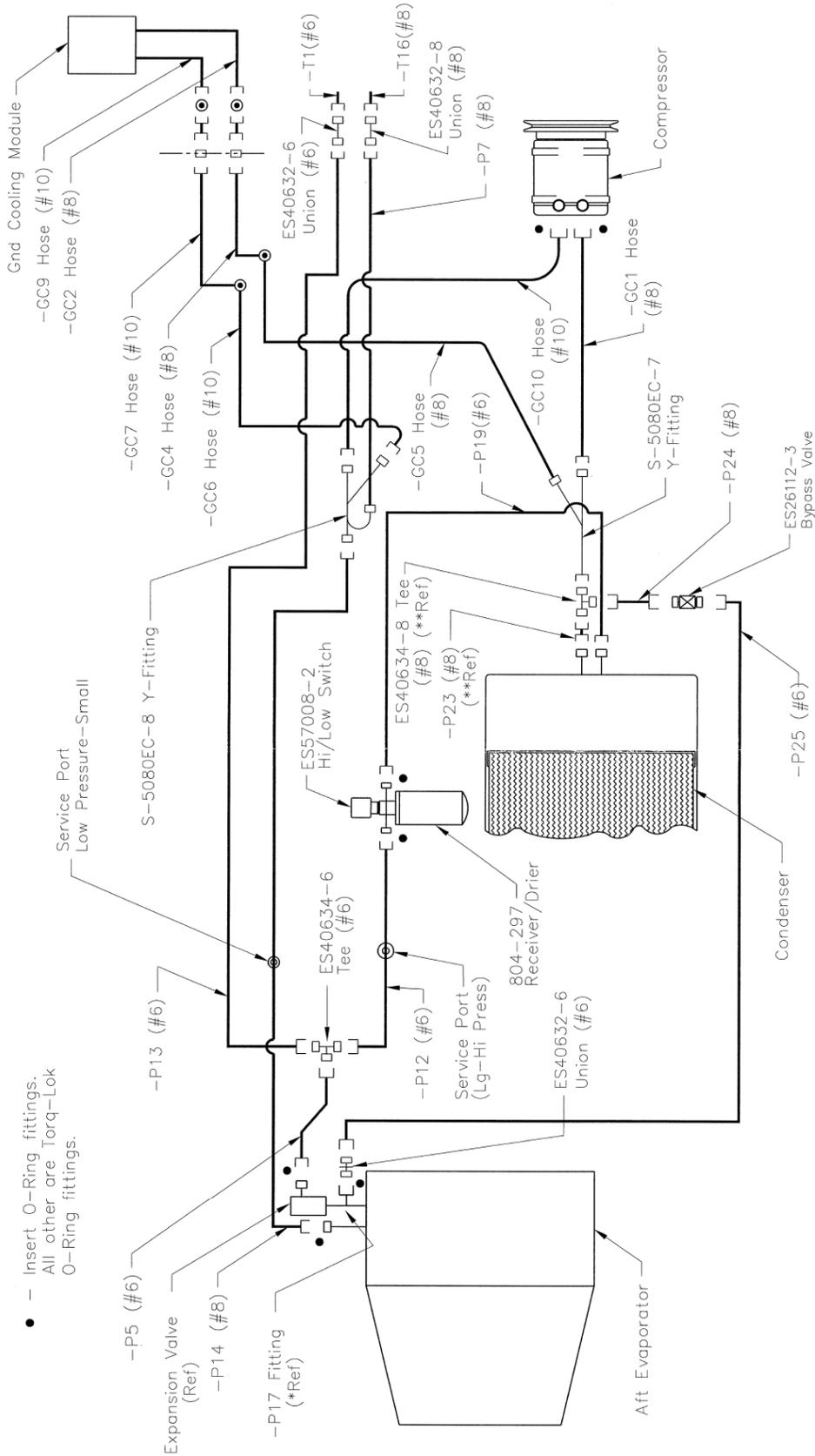


Figure 13: REFRIGERANT PLUMBING SCHEMATIC

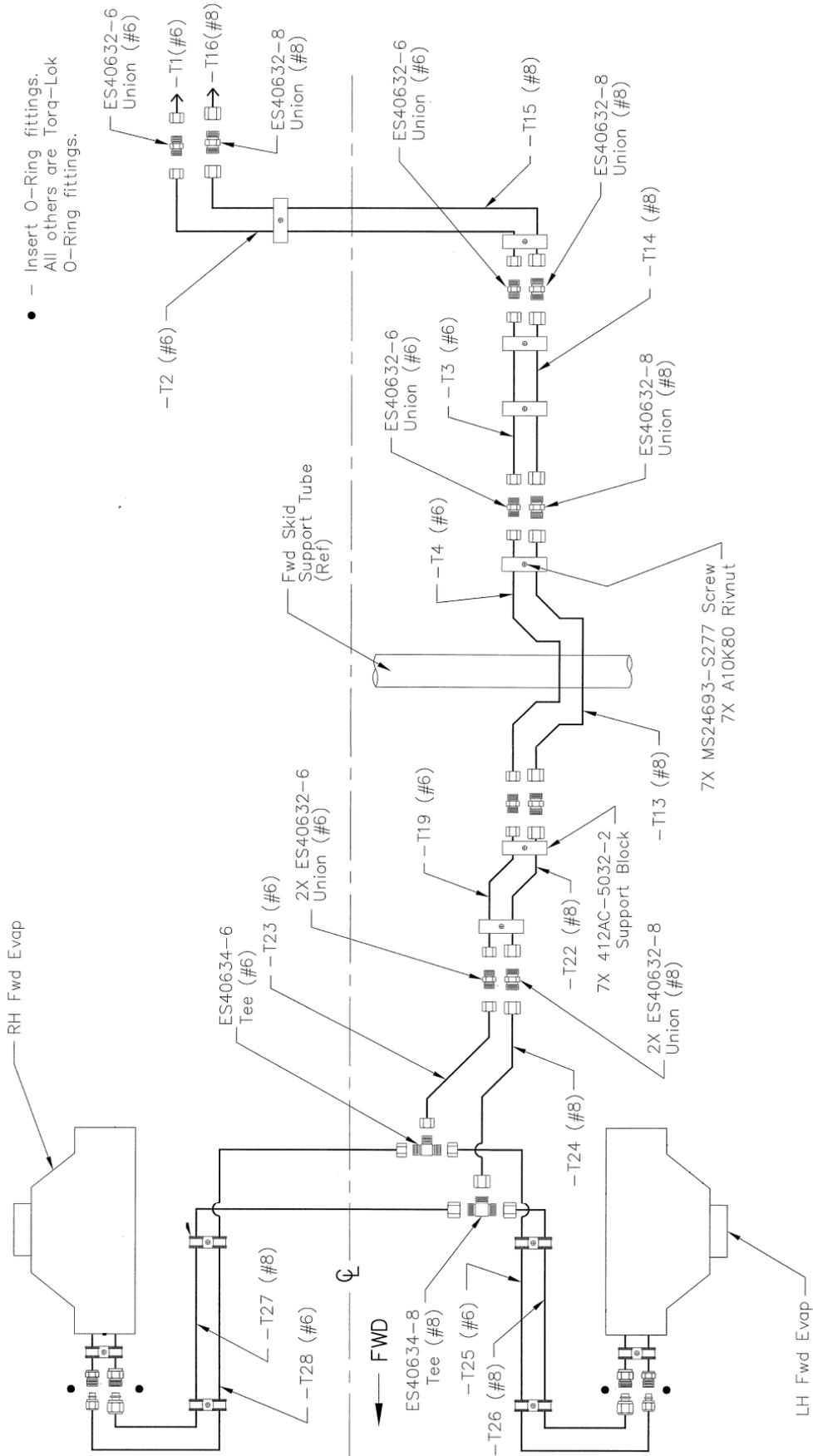
(Refrigerant plumbing schematic continued)



**Figure 14: Refrigerant plumbing schematic (continued)**

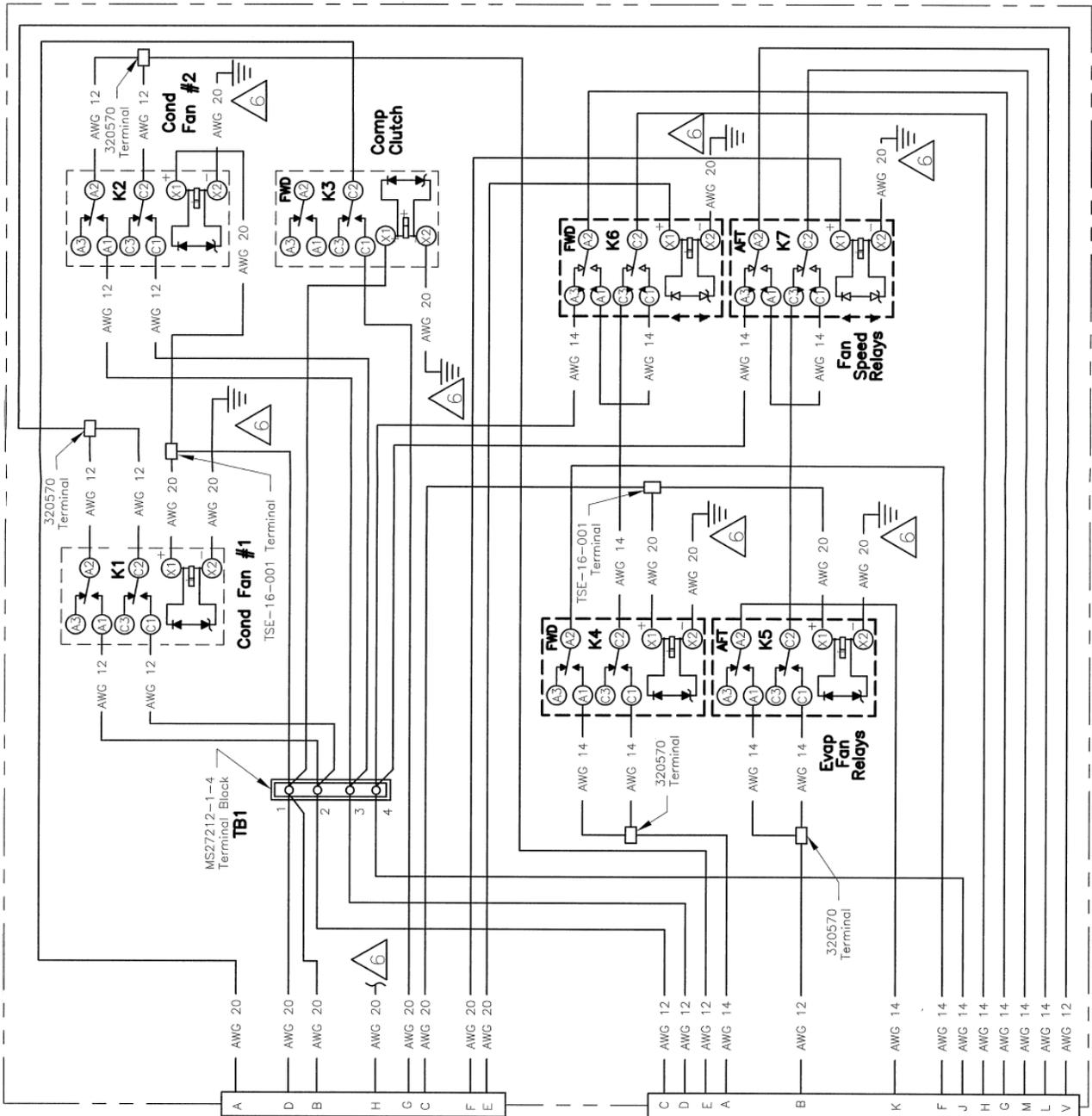
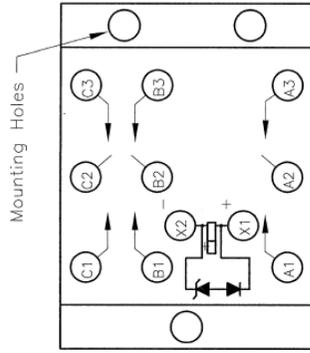
(REFRIGERANT PLUMBING SCHEMATIC CONTINUED)

# AIR CONDITIONER SERVICE MANUAL 412AC-210M



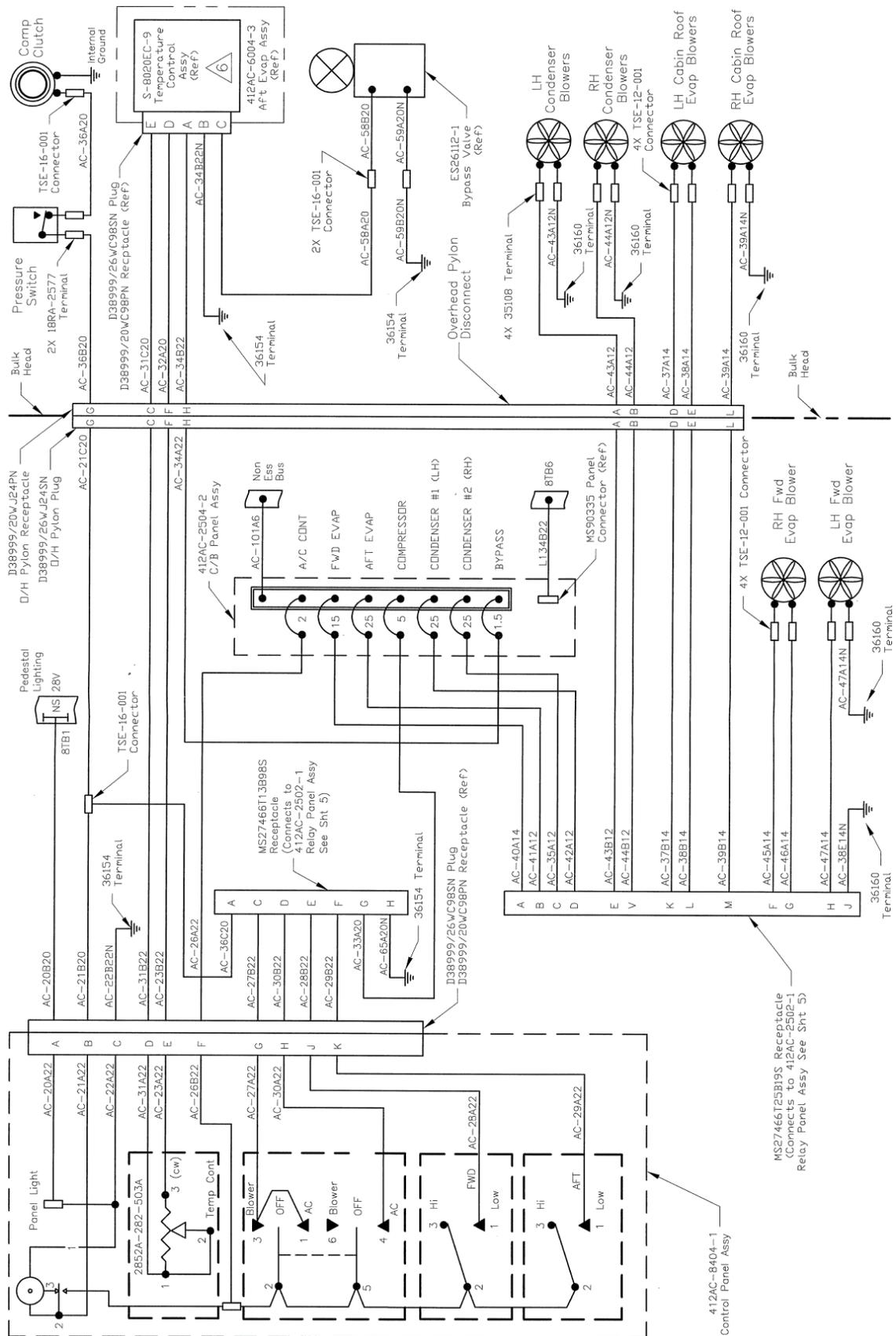
412AC-820 ELECTRICAL SCHEMATIC

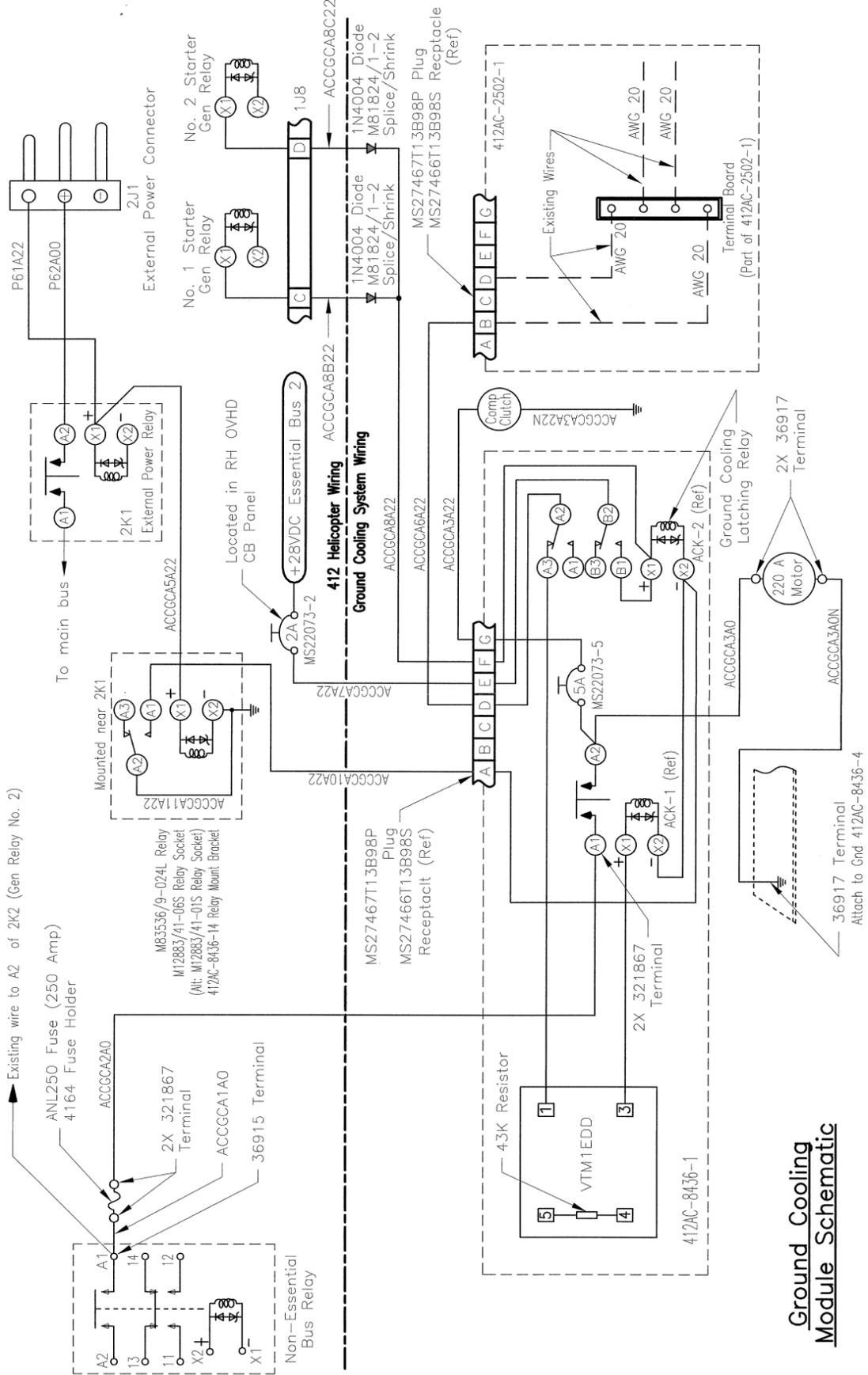
Actual Relay  
Pin Layout



# AIR CONDITIONER SERVICE MANUAL 412AC-210M

(412AC-820 ELECTRICAL SCHEMATIC CONTINUED)





**Ground Cooling Module Schematic**

**APPENDIX A**

**Ground Cooling Unit**

**Maintenance Instructions**

**1. REMOVAL, INSTALLATION / REPLACEMENT OF GROUND COOLING DRIVE MOTOR**

**REMOVAL**

**CAUTION**

It is recommended that the battery and external power be disconnected before starting work.

- A. Disconnect the power cables from terminal post located on the top of the Ground Cooling Drive Motor.
- B. Cut safety wire on Ground Cooling Unit Compressor Belt Tensioning Link; loosen Compressor Mounting bolts, and Turn Belt Tensioning Link to remove the Compressor Drive Belt.
- C. Remove and retain six (6) each AN3-4A Bolts From the base of the 412AC-9020-1 Ground Cooling Pallet Assy.

**CAUTION**

The Ground Cooling Drive Motor is extremely heavy; care should be taken to support the Drive Motor during removal and installation to prevent damage to the motor or the supporting structure.

- D. Lift Ground Cooling Pallet Assembly to gain access to the four (4) Compressor Drive Motor Mounting bolts located on the base of the Ground Cooling Pallet Assembly, and remove and retain bolts.

**NOTE**

It is not necessary to discharge the refrigerant system, or remove the compressor hoses in order to remove the compressor drive motor from the ground cooling unit.

- E. Remove the Ground Cooling Drive Motor from the aircraft.

**INSTALLATION / REPLACEMENT**

- A. Install the Ground Cooling Drive Motor in the appropriate location.
- B. Reinstall, and Torque the four (4) Compressor Drive Motor Mounting bolts to 60 to 85 inch lbs., and safety wire per MIL-P-8564 Paragraph 3.3.7 using MS20995C-32 safety wire.
- C. Reinstall the six (6) AN3-4A Bolts in the base of the 412AC-9020-1 Ground Cooling Pallet Assembly and torque to 60 to 85 inch lbs. (6.77 to 9.60 Nm.).
- D. Reinstall the Compressor Drive Belt on the Compressor Drive Motor Pulley and the Compressor Pulley. Tension the Drive Belt as shown in Figure A-1. On completion of Belt Tensioning, torque Compressor mounting bolts to 95 to 110 inch Lbs (10.74 to 12.43 Nm.).
- E. Reconnect the Power Cables to the terminals located on the top of the Ground Cooling Compressor Drive motor and torque nuts to 30 to 40 inch lbs (3.38 to 4.52 Nm.).
- F. Perform Maintenance Operational Check of system to insure proper function of Ground Cooling System.

## 2. REMOVAL, INSTALLATION / REPLACEMENT OF GROUND COOLING COMPRESSOR

### REMOVAL

#### CAUTION

Refrigeration servicing should be performed by qualified personnel only.

- A. It will be necessary to evacuate (discharge) the refrigerant from the system to remove and replace the Ground Cooling Compressor. Instructions for servicing the system are found in chapter 6 Servicing.
- B. Disconnect the refrigerant hoses from the suction and discharge ports located on the back of the Compressor Assembly.
- C. Remove the safety wire from the Belt Tensioning link, loosen tension and remove belt.
- D. Remove and retain the mounting bolts that mount the compressor to the Compressor Mount and the Compressor Belt tensioning link, and remove the Compressor Assembly.

### INSTALLATION / REPLACEMENT

- A. Install the Compressor Assembly in the appropriate location. Torque all attaching hardware to 95 to 110 inch lbs. (10.74 to 12.43 Nm.).
- B. Replace the O-rings on the refrigerant hoses, and re-connect the hoses to the compressor housing. Torque the #10 Hose fitting to 50 to 55 inch lbs. (5.65 to 6.21 Nm), and torque the # 8 Hose fitting to 40 to 45 inch lbs. (4.52 to 5.08 Nm).
- C. Re-install the belt tension link attaching hardware to the compressor mount and torque to 95 to 110 inch lbs. (10.74 to 12.43 Nm).
- D. Adjust the belt tension per the procedure on Page A-4.
- E. Recharge the refrigerant per the servicing Instructions on Page 15.

#### NOTE

The use of an electronic leak detector should be used any time a component is replaced or the system has been opened, to insure trouble free operation of the air conditioner system.

3. **REMOVAL, INSTALLATION / REPLACEMENT OF GROUND COOLING DRIVE BELT**

**REMOVAL**

- A. Cut safety wire on the Compressor Belt Tensioning Link, and loosen the Jam Nuts.
- B. Loosen Compressor retaining hardware to allow the compressor to pivot freely.
- C. Loosen Belt Tensioning Link, and remove Drive Belt from the Compressor Drive Motor and Compressor Pulley.

**INSTALLATION / REPLACEMENT**

**NOTE**

Proper belt tension is important to insure a long belt service life and to avoid excessive loads on the Compressor, and Drive Motor Bearings.

**NOTE**

The belt tension should be checked, and re-adjusted, if necessary after the first two hours of operation for a newly installed belt.

- A. Install, and or replace the Compressor drive belt.
- B. Adjust the belt tension by turning the belt tension link (See Figure A-1 for belt tensioning information.)
- C. Torque the Compressor mounting hardware to 95 to 110 inch lbs. (10.74 to 12.43 Nm).
- D. Safety wire the Belt Tensioning Link per MIL-P-8564 Paragraph 3.3.7 using MS20995C-32 Safety Wire.

**NOTE**

The required belt tension is 90 lbs. (40.3 kg.). Over tensioning will shorten the belt life, and may damage the clutch, or drive motor bearings. Insufficient belt tension will result in belt slippage, causing excess heat and reduce belt life.

The correct tension is indicated by a .10 inch deflection achieved when 6 to 8 lbs (2.7 to 3.6 Kg.) is applied to the mid span of the Drive Belt. (See Figure A-1 below)

Apply 6 to 8 lbs (2.7 to 3.6 Kg.) to mid span of belt to achieve a .1 inch deflection

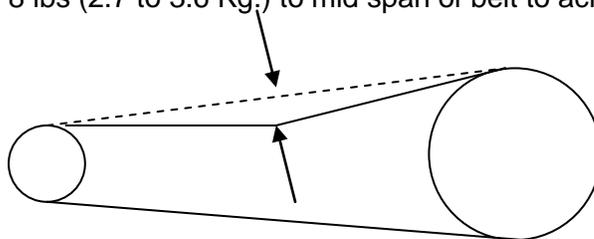


Figure A-1

**APPENDIX B**  
**WEIGHT AND BALANCE INFORMATION**

Weight breakdown – Bell 412 Series Air Conditioner System w/ Ground Cooling:  
Ref. Dwg. 412AC-106-1, -2

<b>Item</b>	<b>Wt. (lbs)</b>	<b>Arm<sub>x</sub> (in)</b>	<b>M<sub>x</sub> (in-lb.)</b>	<b>Arm<sub>y</sub> (in)</b>	<b>M<sub>y</sub> (in-lb.)</b>
Total (-1 or -2 installation)	241.90	134.6	32,560	5.0	1,210