

**PARAVION TECHNOLOGY, INC.
2001 AIRWAY AVENUE
FORT COLLINS, COLORADO 80524**

REPORT NO. PR-407AC-910M

INSTALLATION INSTRUCTIONS

FOR

AIR CONDITIONING SYSTEM

BELL 407 SERIES HELICOPTERS

REVISIONS

<u>Rev.</u>	<u>Date</u>	<u>Description</u>	<u>By</u>
N/C	06/18/1997	Original	R.E.B.
A	12/12/1997	Revised page I-B to install support angle before drain pan. Added simplified belt replacement procedure, page I-B 3.	R.E.B.
B	01/10/2000	Updated to current format, updated item numbers due to a change in the BOM.	M.R.
C	08/10/2000	Updated precautionary information and system checkout.	M.R.
D	03/01/2002	Updated system pressure and weight and balance data Pages 21, 28.	G.P.
E	06/07/2002	Added -3 installation for compressor drive pulley pages 4, 5 and 6. Updated to current format.	J.B.
F	06/11/2003	Added Seco7 seal information to section 8, updated torque table (Table I).	R.Y.
G	04/12/2006	Added instructions for double aft evaporator drain, page 8	R.E.B.
H	07/09/2007	Removed obsoleted Item No. References, Electrical Inst'n page 12	R.E.B.
J	02/02/2009	Added note, page 9, to possibly shorten 407AC-5017-1 Tube. Plenum assy's were attached above the chin bubble upper sill and just forward of the closeout panel (Sec. 6.9 thru 6.11).	R.E.B.
K	06/08/09	Added Notes to return certain couplings	R.E.B.
L	07/02/2012	Revised instructions and troubleshooting tables , included duct covers	L. S.

REFERENCES

1. Drawing No. 407AC-110; System Configuration
2. Drawing No. 407AC-210; Condenser Installation
3. Drawing No. 407AC-310; Compressor Installation
4. Drawing No. 407AC-410; Forward Evaporators Installation
5. Drawing No. 407AC-460; Aft Evaporator Installation
6. Drawing No. 407AC-510; Plumbing Installation
7. Drawing No. 407AC-610; Electrical Installation
8. Maintenance Manual, appropriate chapters BHT-ALL-SPM
9. AC43.13-1a; Acceptable Methods, Techniques and Practices/Aircraft Inspection and Repair
10. Applicable Bell Maintenance Manual(s)
11. BHT-ALL-SPM Standard Practices Manual
13. Parker Publication NO. 4400-B.1, safety guide for selecting and using Hose, Fittings, and Related accessories
14. SECO 1007 Installation Procedure and Torque Values For Seco7

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1.0 INTRODUCTION

- 1.1 This document is to be used as a guide for installation of the air conditioning system using HFC-134a refrigerant, in Bell 407 Series helicopters. These instructions are intended to supplement and aid interpretation of the information contained on the installation drawings.
- 1.2 Additional information required for operation and maintenance of the aircraft are included with these instructions. Upon completion of this installation, the Flight Manual Supplement is to be removed from this documentation and placed in the SUPPLEMENTS section of the Aircraft Flight Manual. The STC is to be removed from this document and placed in the Flight Manual.
- 1.3 **Note that Compressor Drive Pulley installation (Ref. Dwg. 407AC-310, -3, -4 installations) requires modification of the existing Bell coupling (P/N 406-040-316-101) to be accomplished by Paravion Technology, Inc. The drive shaft should be disassembled reference Section 5.0 of this document. The serviceable coupling and documentation should be shipped to Paravion Technology, Inc. for modification.**

2.0 PRECAUTIONARY INFORMATION

- 2.1 This air conditioning system uses HFC-134a cooling fluid. The molecular structure of HFC-134a is smaller than R-12, resulting in greater leak potential. It is very important to follow the precautionary steps listed below in order to minimize leaks.
- 2.2 Care must be taken to prevent contaminants from entering the system tubing and components through all steps of the installation process.
- 2.3 Installer fabricated components must be de-burred, cleaned, and burnished prior to installation. (Example: cutting and flaring of supplied tubing).
- 2.4 All lines and components should remain sealed until final assembly to minimize any contamination.
- 2.5 Flush all plumbing parts prior to installation. This step can be omitted for all major components (examples: compressor, evaporator) since they are pre-cleaned at the factory.
- 2.6 AN and SAE flare fittings are used throughout the system. Excessive over-tightening of these fittings may strip the threads and cause leaks. See Table I for Torque Specifications.
- 2.7 The evaporators are preset at the factory to provide optimal performance. Therefore balancing the evaporators should not be necessary. If needed, follow the Evaporator Balancing Procedure within the System Charging Section.

3.0 AREAS OF ACCESS

NOTE: Most efficient installation of the air conditioning assembly is achieved by first accomplishing the following tasks:

- 3.1 Disconnect and remove battery.
- 3.2 Remove cabin seats and interior furnishings to gain access for system installation; reference drawings 407AC-410, -460, -510 and -610.

- 3.3 Remove all cargo compartment inspection panels; reference drawings 407AC-460, -510 and -610.
- 3.4 Remove engine cowling, oil cooler cowling and #1 tail rotor drive shaft; reference drawing 407AC-310 and BHT-407-MM-7.

4.0 CONDENSER INSTALLATION

Dwg. 407AC-210, for 407AC-110 Installation

- 4.1 Reference sheets 1 and 2, temporarily place the condenser assembly against the helicopter belly. Locate cut-out area and mark belly fairing. Remove condenser. Verify cut-out dimensions. Remove P/N 206-033-320-001 cover. Cut fairing and cover separately.
- 4.2 Reference sheet 2; temporarily insert the condenser in the cut-out. Re-locate, and re-install the modified cover. Per the drawing, match-drill condenser mounting holes in cover and fairing (8 places) and remove condenser.

NOTE: The condenser inlet and outlet tubes must enter the cut-out at the cover location. The condenser is then turned 180 degrees to its final position with inlet and outlet tubes facing aft.

- 4.3 Reference View C, mark fuel and oil-drain tubes approximately 0.5 inch below the lower surface of the baggage compartment floor. Reference BHT-407-MM-4, BHT-407-IPB (Fig. 53-40 at item of this document). Remove drain lines, and cut to mark. Re-install the drain lines. Reference sheet 1, drain line re-location, and Sheet 4, drill 0.50" holes for the indicated flexible tubing extension.
- 4.4 Reference Views B and C, locate and mark louver cut-outs. Cut openings as indicated, using the indicated panels (Ref. Detail D, Detail E) as a guide. Match- drill screw holes (0.173 dia.).
- 4.5 Reference previously accomplished cut-outs, clean exposed honeycomb edges and a 1 inch width on the inside of the shell using solvent according to BHT-ALL-SPM procedures. Fill exposed honeycomb with EA-9309 or METALSET A-4 adhesive. Also using EA9309 or METALSET, bond indicated fastener strips/plates in place inside the fairing shell. Remove excess adhesive squeeze-out and re-seal any air pockets along edges as required. After adhesive cure check fastener strips/plates for proper adhesion.
- 4.6 Reference Detail K; install nut-plate to cover plate using indicated rivets.
- 4.7 Complete electrical and plumbing installations of condenser.
- 4.8 Complete condenser assembly and inlet vents installation after systems operational check has been completed.

5.0 COMPRESSOR INSTALLATION

Dwg. 407AC-310, for 407AC-110 Installation

NOTE: Helicopter configuration in the area of the compressor installation may vary. Refer to drawing 407AC-310, Sheet 1, Note 3 to determine compressor installation configuration prior to beginning installation. Note that the exiting coupling must be returned to Paravion Technology, Inc. for modification if installing 407AC-310-3 or 407AC-310-4 configuration.

- 5.1 Refer to BHT-407-MM-7 to remove the number 1 tail rotor drive shaft and flywheel (if applicable) from the oil cooler fan shaft.

- 5.2 Install the support angle assembly as shown, drilling out the necessary rivets and match-drilling the support angle to existing rivet holes. Remove, clean, de-burr, and install support angle using indicated hardware.
- 5.3 Locate the bracket support on the engine drain pan, forward of the access panel's upper flange as shown.
- 5.4 Match-mark and drill the bottom flange of the support to the two existing screw locations in each access panel and rivet location on left-hand outboard channel of drain pan. Remove the access panels from the drain pan and trim to remove the top flange. This allows aircraft maintenance access as necessary.
- 5.5 Re-install the access panels and support using existing access panel hardware.
- 5.6 Locate and drill rivet holes through the support as shown using equal spacing and maintaining minimum edge distance. Remove support bracket, de-burr, clean, and complete support installation.
- 5.7 Temporarily install the compressor mount bracket assembly to the support angle. Install spacer. Match-mark and drill the previously installed support to the compressor mount bracket. Remove bracket and enlarge holes in support to indicated size, then clean and de-burr parts.
- 5.8 Install clip nuts on support and complete compressor mount bracket installation with indicated hardware.
- 5.9 Remove the support bolt from the bearing housing in front of the oil cooler. Replace with indicated hardware and install upper strut brackets. Using existing nut, torque the bolt in accordance with maintenance manual BHT-407-MM-7. Install cotter pin.
- 5.10 Locate lower strut brackets. Remove indicated rivet and drill to indicated size. Temporarily install brackets and match-drill firewall through brackets. Remove, clean and de-burr. Secure brackets using indicated hardware.
- 5.11 Install turnbuckle strut assemblies, adjusting the turnbuckle as necessary to align with the supports. Secure using indicated hardware.
- 5.12 Adjust turnbuckles evenly, to a slight tension (3 to 5 in.-lb. torque) to place the bearing housing legs in a slight compression. Lock turnbuckles at selected tension using the lock nuts.
- 5.13 Compressor drive pulley installation: Refer to drawing NOTE 3 to verify required installation configuration.
NOTE: If you are removing the flywheel per BHT 407-11-30, order the BHT kit for aircraft without air-conditioning installed.
- 5.13.1 Use the indicated replacement bolts to install the compressor drive pulley to the flywheel adapter and existing disc pack. Install the modified flywheel assembly to the oil cooler fan shaft.
- 5.14 Re-install the #1 TR drive shaft in the following sequence:
 - 5.14.1 -2 installation (with flywheel); Refer to Drawing 407AC-310, -2 Installation
 - 5.14.1.1 Place the compressor drive belt over the drive pulley.
 - 5.14.1.2 Assemble the aft-end of the #1 TR drive shaft and existing coupling components (washers and spacers, and drive shaft flange, reference BHT-407-MM-7).

NOTE: START THE NUTS ON THE BOLTS BY HAND BUT DO NOT TIGHTEN THEM AT THIS TIME.

- 5.14.1.3 Temporarily remove the two beveled washers from each side of the engine coupling-to-disc-pack fastener stack-up, and temporarily install the forward end of the #1 TR driveshaft to the engine shaft flange.

NOTE: The beveled washers must be temporarily removed from between the engine shaft and coupling disc pack to allow completion of the #2 coupling installation using standard tools. THESE BEVELED WASHERS ARE NECESSARY AND MUST BE REINSTALLED AT A LATER TIME.

- 5.14.1.4 Move the #1 TR drive shaft and flywheel assembly toward the engine. This will allow use of a short socket to hold the bolt heads in the pulley recess.

- 5.14.1.5 Complete installation of the nuts/bolts in the #2 coupling disc pack. Torque bolts per BHT-407-MM-7 procedure.

- 5.14.1.6 Move the #1 TR drive shaft and flywheel adapter assembly aft, and insert the previously removed beveled washers between the engine shaft flange and coupling disc pack.

WARNING: The beveled washers MUST BE INSTALLED; reference BHT-407-MM-7 coupling configuration requirements. Failure to reinsert the beveled washers may result in failure of the tail rotor drive shaft installation.

- 5.14.1.7 Complete coupling bolts installation in accordance with BHT-407-MM-7.

5.14.2 -3 installation (without flywheel), Refer to Drawing 407AC-310, -3 installation

- 5.14.2.1 Reinstall the #1 TR driveshaft in the following sequence:

- 5.14.2.2 Place the compressor drive belt over the drive pulley.

- 5.14.2.3 Assemble the aft-end of the #1 TR drive shaft and existing coupling components (washers and spacers, and drive shaft flange reference BHT-407-MM-7).

NOTE: START THE NUTS ON THE BOLTS BY HAND BUT DO NOT TIGHTEN THEM AT THIS TIME.

- 5.14.2.4 Temporarily remove the two beveled washers from each side of the engine coupling-to-disc-pack fastener stack-up, and temporarily install the forward end of the #1 TR driveshaft to the engine shaft flange.

NOTE: The beveled washers must be temporarily removed from between the engine shaft and coupling disc pack to allow completion of the #2 coupling installation using standard tools. THESE BEVELED WASHERS ARE NECESSARY AND MUST BE REINSTALLED AT A LATER TIME.

- 5.14.2.5 Move the #1 TR drive shaft and pulley assembly toward the engine. This will allow use of a short socket to hold the bolt heads in the pulley recess.

- 5.14.2.6 Complete installation of the nuts/bolts in the #2 coupling disc pack. Torque per BHT-407-MM-7 procedure.

5.14.2.7 Move the #1 TR driveshaft assembly aft, and insert the previously removed beveled washers between the engine shaft flange and coupling disc pack.

WARNING: The beveled washers **MUST BE INSTALLED**; reference BHT-407-MM-7 coupling configuration requirements. Failure to reinsert the beveled washers may result in failure of the tail rotor drive shaft installation.

5.14.2.8 Complete coupling bolts installation in accordance with BHT-407-MM-7.

5.15 Temporarily install the compressor assembly in the mount bracket using indicated hardware. Allow compressor to pivot on mount plate.

NOTE: Before placing the compressor in the mount bracket, the drive belt must be placed over the compressor pulley.

5.16 Install the tensioner. **DO NOT PLACE TENSION ON THE DRIVE BELT AT THIS TIME.**

5.17 With belt tensioner adjusted to maximum length, slide adjustable plate on compressor mount. To adjust compressor alignment to the TR drive pulley apply tension to drive belt by hand and tighten mount plate bolts. Using a straight edge, check alignment and adjust compressor position on sliding plate if necessary. Re-tighten bolts, this is where the compressor will be permanently mounted.

5.18 Remove compressor and match-drill sliding plate to base plate of compressor mounting bracket assembly through 2 x Ø0.257" holes in sliding plate.

5.19 Disassemble sliding plate from mount plate, de-burr holes and reassemble using the attach bolts through match-drilled holes.

5.20 Reinstall compressor and drive belt.

5.21 Temporarily install restraint and placard with indicated hardware.

5.22 Assure tail rotor drive shaft, forward oil cooler shaft bearing housing, and compressor installations are complete. Tighten the drive belt to 35 pounds tension by adjusting the tensioner. A "KRIKIT" belt tension gauge (GATES P/N 91107) or equivalent tool is useful to accurately set belt tension. Lock the belt tension adjustment using the jam nuts.

WARNING: **DO NOT OVER-TIGHTEN THE BELT.** Excessive strain on the tail rotor drive train may cause premature bearing failure. Excessive belt tension may shorten belt life and may damage compressor clutch bearings. However, insufficient belt tension will reduce belt life due to slippage.

5.23 Install the safety strut assembly using indicated hardware. Lock the assembly at the proper length so that it is not under tension or compression. (Not applicable, obsolete)

5.24 Torque all remaining compressor attachment hardware and safety wire as required.

5.25 Check bearing housing alignment in accordance with maintenance manual procedures, BHT-407-MM-7.

5.26 Check security of all hardware installations, and seal all adjoining firewall surfaces using MIL-S-8802F Class B2 or equivalent.

5.26.1 To replace the drive belt, loosen the compressor mounting bolts and tensioner bolts to remove the existing belt from the compressor pulley.

5.26.2 Remove the two bolts that attach the #1 TR driveshaft to the engine coupling disc pack.

- 5.26.3 Slide the #1 TR driveshaft aft, and work the belt forward and off the drive shaft.
 - 5.26.4 Install the new belt over the shaft and work it aft to the drive pulley.
 - 5.26.5 Reinstall the Thomas coupling hardware, and torque the bolts in accordance with BHT-407-MM-7.
 - 5.26.6 Check belt alignment and correct as necessary.
 - 5.26.7 Complete the compressor installation in accordance with the steps 5.19 through 5.23 above.
- 5.27 Complete plumbing and electrical installation, ref. Detail E of dwg. 407AC-310 and Dwgs. 407AC-510, 407AC 610.

6.0 FORWARD EVAPORATOR INSTALLATION

Reference Drawing 407AC-410: Forward Evaporators

- 6.1 The forward evaporators are installed in the nose, on each side of the battery box. Each evaporator is supported by the battery box, and by the chin bubble upper sill.
- 6.2 Reference Detail A, drill mounting hole through each side of the battery box at the indicated location. Loosely install mount angles to the battery box using the indicated hardware.
- 6.3 Place the indicated beams on the chin bubble upper sill and temporarily install to the battery box. Adjust the beam for best fit on the sill, perpendicular to the side of the battery box. Match-drill the sill $\text{Ø}0.201$ and temporarily install using indicated hardware.
- 6.4 Temporarily install the left-hand evaporator. Locate the inboard evaporator attachment hole in the battery box, and match drill ($\text{Ø}0.201$). Remove the evaporator, support beams, and angles. Clean and de-burr holes.
- 6.5 Install left-hand evaporator, angle, and beam using indicated hardware.
- 6.6 Install right-hand evaporator, angle, and beam using indicated hardware.
- 6.7 Reference View A-A', drill ($\text{Ø}0.813$) holes below evaporator drains in window retainer. Complete drain tube installation.
- 6.8 Complete installation and operational check of plumbing and electrical systems, reference drawings 407AC-510 and 407AC-610.
- 6.9 **Caution: Assure clearance of fastener locations from installed components before drilling holes.** Reference View B-B'. Using plenum assembly as template, mark hole locations. Drill ($\text{Ø}0.250$) holes on either side of the instrument panel to mount the plenum assemblies in the indicated positions.
- 6.10 Install the indicated rivnuts and attach the plenum assemblies with the indicated screws. Install flexible duct between the evaporator and plenum on each side.
- 6.11 Install optional duct cover as follows:
 - 1) Using talcum powder coat at least 6" of the duct on one end.
 - 2) Using a needle, thread string or twine through end of the scat tube to make a loop and tie off. The string should be about 60" long to run through the tube and the cover (you may need to weight the string to get it to travel through each item well).

- 3) Start the cover on the end of the scat tube and have another person pull on the string through the cover working to keep the end of the cover from rolling up.
- 4) Work the tube until the desired length is covered, remove string, trim off excess cover length and install duct.

- 6.12 Ensure that the duct does not interfere with pilot/copilot's ability to operate tail rotor pedals. For aircraft with a Paravion Technology, Inc. Heater installed, ensure that ducting does not interfere with fwd heater ejector airflow. Secure duct using the provided adel clamp and ty-wraps.

7.0 AFT EVAPORATOR INSTALLATION

Reference 407AC-460; Aft Evaporator

- 7.1 Remove hat-bin and lay insulation blanket forward. Remove 206-032-309-215 bracket if installed.
- 7.2 Reference –1 INSTALLATION, Detail B, View C-C, install mounting brackets to equipment rack aft of hat bin using indicated shim and rivets.
NOTE: Assure correct spacing of the brackets using the evaporator assembly as a guide.
- 7.3 Reference Detail B, Views C-C, place evaporator inside of brackets. Match-drill brackets (Ø0.201) to pre-drilled holes in evaporator side plates.

NOTE: Assure proper drainage of evaporator with the aircraft on a level surface.

- 7.4 Reference View C-C, Detail D, temporarily place flexible duct and duct adapter on evaporator inlet. Temporarily install insulation blanket and mark inlet doubler location. Remove blanket and cut hole. Seal blanket with duct tape or equivalent; install doublers to blanket with indicated hardware, and apply hook & loop tape. Remove duct adapter and duct. Reinstall blanket.
NOTE: Trim length of flexible duct as required preventing distortion of blanket.
- 7.5 Ref. View A-A, temporarily install hat-bin with several screws. Locate hole for screen. Remove hat-bin and cut openings.
- 7.6 Match-drill frame to hat bin and components. Disassemble, clean, and install frames, screen, and filter with indicated hardware.
- 7.7 Ref. View C-C, View E-E, route evaporator drain lines as indicated. Note that service experience has shown that a drain line must be installed in the forward and aft ends of the evaporator. Provision for this drain line should be included in the evaporator supplied with this kit. If it is not, please refer to paragraph 7.7.1 through 7.7.4 below, for evaporator housing modification.
- 7.8 Reference View B-B, View C-C, Locate and drill 0.75 hole in the shelf behind the evaporator, 0.80 hole in the right-side forward corner of the shelf, and 0.50 hole in baggage compartment floor. Complete indicated drain line installation. Terminate drain line in condenser compartment.

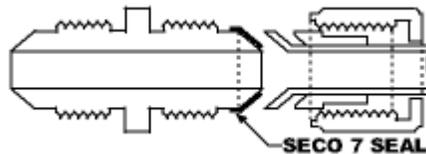
NOTE: Drain line routing should pass between outer skin and baggage compartment side inspection panel. Clean and seal honeycomb panel per BHT-ALL-SPM and allow adhesive to cure.

- 7.9 Reference View G-G, cut openings in overhead panel, and secure duct adapters to panel with indicated hardware.
- 7.10 Reference View H-H, attach flexible outlet duct to outlet tee using Ty-rap. Install duct to evaporator outlet, install clamp. Route ducts to avoid electrical cables and flight controls.

NOTE: Maintain 0.250-inch clearance minimum in all flight control positions.

- 7.11 Complete evaporator plumbing and electrical systems, ref. Dwgs. 407AC-510, & 407AC-610.
- 7.12 Perform functional test and leak check of system.
- 7.13 Reinstall hat-bin and interior. Connect evaporator outlet ducts to cabin overhead using Ty-raps.

8.0 **PLUMBING INSTALLATION** Ref. Dwg 407AC-510 Installation



8.1 Precautionary Information

- 8.1.1 Care must be taken to avoid contamination of the plumbing and system components during installation. End plugs, found in components should not be removed before final assembly of plumbing lines.
- 8.1.2 The plumbing is primarily aluminum tubing, joined to components using flare fittings. It is not possible in all cases to provide pre-assembled plumbing. Sufficient lengths of tubing, and fittings, have been supplied to make up these sections of refrigerant line. The lines should be made up in accordance with drawing Detail T. Tube bending and SAE 37 degree flaring tools are required.

NOTES:

1. The Low-Pressure Tube (Ref. Detail A) leading from the aft evaporator to the pan penetration fitting may require trimming by as much as 8 inches. This is accomplished by sliding the flare fitting assembly away from the end and cutting the tube to proper length. The tube end must be flared before installation.
 2. Before final tube assembly installation flush with cleaning fluid and compressed air (see consumables list in Section 3.2).
 3. A smooth burnished flared surface is critical to obtain a good seal.
- 8.1.3 To preclude saturation of the desiccant, the dryer bottle caps should not be removed until just prior to evacuation and charging of the system.
 - 8.1.4 Seco7 seals (soft, malleable crush washers) are provided with the installation hardware, to provide a lower yield gasket material between the tube flare and fitting. The installation procedure for these seals is as follows:
 - 8.1.4.1 Referring to the installation drawings, select the correct size seal for the flared fitting.

- 8.1.4.2 Clean all fittings thoroughly, coat fitting threads at cone end of connector sparingly with SP-20 or equivalent oil compatible with refrigerant HFC-134a.
- 8.1.4.3 Install Seco7 seal onto male flare portion of fitting.
- 8.1.4.4 Thread tube nut onto male fitting several turns with fingers until connection is snug. If tube nut cannot be tightened snugly with fingers, disassemble and correct problem to prevent assembly damage to Seco7 seal.
- 8.1.4.5 Tighten tube nut to torque value specified in Table I.
- 8.1.4.6 Allow fifteen seconds elapsed time for compression of Seco7 seal to occur.
- 8.1.4.7 Retighten tube nut to torque value specified in Table I in order to compensate for the compression yielding of the Seco7 Seal.

NOTE: Do not attempt to correct leakage or misalignment of a joint by overtightening. Disassemble and check for nicks, burrs, dirt, etc. reassemble using new parts if necessary. Seco7 seals must be replaced if the joint is disassembled.

- 8.1.5 It is acceptable to assemble the flared fittings without the use of Seco7 seals. In this case the following procedure should be observed:
 - 8.1.5.1 Clean the fitting thoroughly and apply a light coat of SP-20 or equivalent oil compatible with refrigerant HFC-134a to flare surfaces.
 - 8.1.5.2 Carefully align flare fitting ends and hand-tighten to seat the flare, then torque per Table I.
 - 8.1.5.3 Heat fitting using a shop heat gun and then re-torque per Table I to ensure a proper seal.
- 8.2 Complete temporary installations of the compressor, condenser, dryer bottle, and the evaporators. Actual order of plumbing installation as described below may be modified for greatest efficiency.
- 8.3 Reference Details C, View D2-D2, for plumbing component and routing from compressor outlet to condenser.
 - 8.3.1 Temporarily install flex hose assemblies (Sheet 2, Detail A) on compressor. Locate bulkhead doubler (Sheet 2, Ref. View A1-A1). Assure that location of pan penetration does not strain hose assemblies.
 - 8.3.1.1 Mark location and remove hose assemblies. Match-drill bulkhead doubler assembly stack-up. Remove components, de-burr, clean, and install using indicated hardware.
 - 8.3.1.2 Locate through-bulkhead fitting (Detail B) on aircraft left-hand side, Ref. Views B1, B2 and B3-B3. Drill, clean, de-burr, and install fitting.
 - 8.3.1.2 Fabricate 1/2" diameter tube, Ref. Detail T and install between fitting in engine pan and bulkhead fitting.
 - 8.3.1.4 Fabricate 1/2" diameter tube and install between bulkhead fitting and condenser. Secure using indicated hardware.

- 8.4 Locate dryer bottle in upper right-hand corner of bulkhead. Reference Views B2, B3-B3. Install using indicated hardware. Temporarily install tube assembly to dryer bottle inlet and route tube to condenser.
- 8.5 Locate and install bulkhead elbow (Detail B). Temporarily install tube assembly (View B3-B3) to dryer outlet and route tube to elbow.
- 8.6 Complete aft evaporator installation, Ref. Dwg. 407AC-460.
- 8.7 Temporarily install tube assembly (Sheet 5, Detail C) and tee (Sheet 6, View D1) to aft evaporator.
- 8.8 Reference Detail B, View B2, Detail C, and Detail D, View D1, fabricate and route 3/8" diameter tube from bulkhead elbow to tee location. Secure tubing using indicated hardware. Complete tee and tube assembly to evaporator.
- NOTE:** High-pressure tubing is routed along the right-hand side of the overhead box-beam.
- 8.9 Reference Detail D, Views D1, D3-D3, E1-E1, E3-E3, fabricate and install 3/8" diameter tubing forward to base of control tunnel. Secure using indicated hardware.
- 8.10 Reference Figure 1, Details A and C, locate and install tubing from compressor to aft evaporator (Sheet 2, Detail A).
- NOTE:** Return line routing is along left side of the overhead box-beam.
- 8.11 Temporarily install tee (Sheet 5, Detail C). Fabricate and install short 1/2" diameter tube and elbow to evaporator and tee. Tighten assemblies.
- 8.12 Reference Sheet 7, Detail D, Views D2, D3-D3, install 3/4" tubing from evaporator to base of control tunnel. Join tube assemblies using indicated union and secure using indicated hardware.
- 8.13 Reference Sheets 8, 9, & 10, VIEWS E1-E1 through E4-E4 to complete plumbing installation to forward evaporators as follows:
- NOTE:** Refer to Sheet 11, Detail F (4 views) for details of panel modifications necessary to route plumbing through forward console enclosure.
- 8.14 Ref. Section E3-E3, and cutout detail, modify web cutout to existing 7/8" dia. hole. Clean and de-burr edge. Install grommet with MIL-S-8802F Class B2 or equivalent.
- 8.15 Ref. view E2-E2, Section E3-E3. Temporarily install 3/4" tube assemblies. Install clamp attachment hardware, per drawing requirements. Install insert (Item 28), Ref. BHT-ALL-SPM, using EA9309. Allow time to cure.
- NOTE:** Maintain 0.250-inch minimum clearance from flight controls in all positions.
- 8.16 Ref. Detail T, view E1-E1, Section E3-E3, E4-E4, fabricate and install 3/8" tubing using indicated hardware.
- 8.17 Ref. views E1-E1, E2-E2, install pressure and return tee's.
- 8.18 Complete forward evaporator installations, Ref. Dwg. 407AC-410.
- 8.19 Ref views E1-E1, E2-E2, Detail F, fabricate 1/4" and 1/2" tube assemblies (Ref. Detail T). Install using indicated fittings and hardware.
- 8.20 Complete inspection panel cutouts and install grommet (view F3-F3).
- 8.21 Tighten all plumbing fittings and check security of attachment hardware. Check for proper clearances from flight controls and airframe structure.

8.22 Apply vacuum to system and check for leaks. Tighten loose fittings as required.

9.0 **ELECTRICAL SYSTEM INSTALLATION**

Dwg. 407AC-610, 407AC-110-1 Installation

To avoid unnecessary disassembly, work on the electrical installation should proceed with completion of component installation. (See drawing 407AC-110). In addition to pre-assembled wire harness, this kit includes single wire lengths and crimp-on connectors for use in completing electrical wire routing. These wire assemblies are marked in accordance with the drawing notation.

References: BHT-407-MM-10

NOTE: Follow existing wire routing where possible.

- 9.1 Determine installation configuration required by the aircraft interior.
- 9.2 Ref. Sheet 1, 3, Provide power to the AIR COND. breaker from the 24V Bus. Provide power to the AIR COND. switch using indicated wire.
- 9.3 Install indicated wire/fuse assemblies between the AIR COND. switch, the condenser/drier bottle junction and the evaporator fan switches. Terminate with connectors provided.
NOTE: Wire assembly installations that travel along the same routes to separate components should be accomplished at the same time.
- 9.4 Install wire harness assemblies between fan switch and fwd. Evaporators. Terminate with connectors provided. Provide evaporator grounds.
- 9.5 Route wire assemblies to their respective component locations. Refer to components installation drawings.
- 9.6 Install wire assemblies through deck, (Ref. W. L 56.5 aft of baggage compartment) route to dryer bottle and remaining component locations.
- 9.7 Terminate wire assemblies as component installations are completed. Provide grounds using indicated hardware.
- 9.8 Install compass placard as instructed on drawing.

10.1 **SYSTEM CHECK**

Reference: Troubleshooting Chart as necessary

- 10.1 It is good practice to thoroughly inspect all connections and line routing before proceeding to charge the system.
- 10.2 Perform an electrical system function check of the forward and aft evaporator controls, the compressor clutch, and the condenser fan Ref. Table III, Troubleshooting as an aid in resolving issues.
- 10.3 Charge and operate the system according to the procedures contained in Chapters 12 through 16 of this document and in the Flight Manual Supplement (Appendix A).
- 10.4 If the installer does not have the necessary equipment or expertise to flush and test the system, then a local air conditioning firm with proper supervision should be utilized prior to reinstallation of all cowlings, panels, and interior components.
- 10.5 Re-install all panels, cowling and hardware removed during installation.

- 10.6 Compressor drive belt tension should be checked after System Run-Up and Operation Check, and again after the first 2 hours of operation, reference Compressor Installation.

WARNING: DO NOT OVER-TIGHTEN THE BELT. Over tightening puts excessive strain on the tail rotor drive train and may result in premature bearing failure. Over tightening the belt also will shorten belt life and may damage compressor clutch bearings. Insufficient belt tension will result in belt slippage, excess heat, and reduced belt life. A "KRIKIT" belt tension gauge (Gates P/N 91107) or equivalent tool should be used to check belt tension.

11.0 SYSTEM CHARGING CONSIDERATIONS

Reference: Troubleshooting Chart as necessary

11.1 Safety Precautions

The refrigerant used in the air conditioner system is HFC-134a. Other refrigerants, such as R-12, must not be introduced into the system. HFC-134a has been shown to be nonflammable at ambient temperature and atmospheric pressure. However, tests have indicated that at pressures above atmospheric and with air concentrations greater than 60% by volume, combustible mixtures can be formed. Under no circumstance should any bulk storage cylinder, filling equipment, charging or refrigerant reclaim or recovery system be pressure tested with AIR/HFC-134a mixtures. NEVER charge an air conditioning system, which has not been evacuated first. This does not mean that additional charge cannot be added, but all lines should be vented so that they are filled with refrigerant before adding charge to the system. NEVER use compressed air to flush the refrigerant from an air conditioning system.

NOTE: Servicing of CFC and HCFC systems should be preformed by licensed, qualified personnel only.

The following further precautions should be observed:

- 11.1.1 The work area should be well ventilated. Route relief and purge vent piping outdoors, away from air intakes. Be certain that the work area is clear of vapors prior to beginning work.

WARNING: INTENTIONAL INHALATION MAY CAUSE DEATH WITHOUT WARNING.

- 11.1.2 Always wear protective clothing when there is a risk of exposure to liquid refrigerant. Wear eye protection and a face shield when servicing any part of the refrigerant system. Liquid refrigerant at atmospheric pressure evaporates quickly and rapidly cools anything that it contacts. To avoid frostbite, care must be taken to prevent liquid refrigerant contact with skin or eyes. If contact does occur, seek medical attention as soon as possible.

- 11.1.3 Avoid operations with high temperatures, such as welding or baking of aircraft finish in the immediate area of any part of the air conditioning system or refrigerant supply tank.

WARNING: AVOID AREAS WHERE OPEN FLAME OR CHEMICAL VAPORS ARE PRESENT WHEN USING REFRIGERANT.

11.2 Tools and Consumables

Servicing of an air conditioning system requires the use of certain special tools and consumables, they are:

11.2.1 Tools

11.2.1.1 Service Manifold with "high" and "low" side gages. This item is used to evacuate the system, to install refrigerant, and to read system pressure following system charging.

11.2.1.2 Electronic Leak Detector for HFC-134a. (TIF model 5550 is suitable).

11.2.1.3 Vacuum Pump.

11.2.1.4 Heat Exchanger Cooling Fin Comb.

11.2.2 Consumables

11.2.2.1 HFC-134a, bulk cylinder.

11.2.2.2 Refrigerant Oil; Sanden SP-10 or SP-20 PAG oil, or equivalent.

11.2.2.3 Pro-Seal 890 or equivalent.

11.2.2.4 HYSOL EA9309 Adhesive, alt. A-4 Metal set or equivalent; SMOOTH ON, INC.

11.2.2.5 Contact Cement, Scotch 1300L or equivalent.

11.2.2.6 0.032" Stainless Lock Wire. Ref. MS20995C32.

11.2.2.7 Virginia # D10E1 cleaning solvent (Flushing Parts) or equivalent.

12.0 SYSTEM LUBRICATION

12.1 Recommended system oil charge should be 7.5 ± 0.5 oz. Compressors are factory charged with 3.5 oz. of oil. An additional 4 oz. of oil should be added to the discharge line prior to charging a new installation.

12.2 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.

13.0 DRYER BOTTLE

13.1 The dryer bottle is located between the condenser and the expansion valve. It contains a desiccant (XH-9) which serves to absorb moisture from the system. To preclude saturation of the desiccant, the dryer line caps should not be removed until just prior to evacuation and charging of the system. The dryer bottle should be replaced whenever the system is discharged.

CAUTION: Before draining or charging any refrigeration system read safety precautions in paragraph 11.1.

14.0 SYSTEM LEAK CHECK

- 14.1 A system which contains a partial charge can be leak tested and recharged, without evacuating the system. A system which has been evacuated should be filled to a pressure of at least 50 psig, if using an electronic leak detector, or higher if using a detector solution.
- 14.2 All leak checks should be conducted with the air conditioner "OFF". Since refrigerant is heavier than air, leaks are most likely detected on the underside of hoses and fittings. Refrigerant will collect in low areas and may provide an erroneous leak indication. The shop area should be well-vented prior to checking for leaks.
- 14.3 If a leak is detected at a fitting, check tightness and security and check for leaks again, if the fitting still leaks, recover the refrigerant. Clean and inspect the fitting and tube assembly for defects. If a defective component or fitting is found, replace. Install a new Seco7 seal and reassemble fitting per Section 8.1.4.
- 14.4 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.
- 14.5 Special Tools and/or Equipment Required:

The following tools and/or equipment are required to leak check a refrigerant plumbing system.

- 14.5.1 Gaseous dry nitrogen, regulated source (0-200 psig).
- 14.5.2 R-134a refrigerant charging manifold with gauges and hoses.
- 14.5.3 Leak check fluid, (soap solution).
- 14.5.4 Assorted hand tools.
- 14.5.5 Hand and eye protection.
- 14.5.6 Thread sealant, P/N 55431. (Loctite).
- 14.5.7 Electronic R134a leak detector.

14.6 Leak Check Procedure

NOTE: These instructions give procedures applicable to a manually operated refrigerant manifold/supply system. If automatic recovery/recycling/recharging equipment is used follow equipment manufacturer's recommendations.

14.6.1 Remove all shrouds, panels, flooring and any other covering which prevents access to refrigerant fittings, connections or components.

14.6.2 Verify all aircraft and/or ground power is off.

14.6.3 Remove service port caps from the A/C system. The high and low pressure service ports are located on the compressor suction header.

14.6.4 Close all manifold gauge valves and verify hose connections are tight.

14.6.5 Connect R-134a refrigerant charging manifold or service unit. R-134a service gauges contain quick-connect fittings to minimize refrigerant loss. To install quick-connect, push on firmly until locked (a "clicking" sound is heard). Hold the grip ring and pull to remove quick-connect fittings.

14.6.6 Connect yellow charging hose to a regulated dry nitrogen source.

NOTE: An adapter is required to connect yellow charging hose to the nitrogen source.

14.6.7 Regulate nitrogen source to a pressure of 200 PSIG maximum.

CAUTION: Do not exceed 200 psig. nitrogen pressure during leak check procedure or damage to expansion valve will result.

14.6.8 Verify all plumbing connections are tight.

14.6.9 Slowly open high pressure (red) manifold valve and allow system pressure to increase gradually until a pressure of 200 psig is achieved. Allow time for system pressure to equalize across expansion valve and note final system pressure.

CAUTION: During this procedure protective eye wear and gloves should be worn to prevent operator injury.

14.6.10 Use electronic leak detector to locate potential leak sources. Apply soapy leak check fluid to each connection to pinpoint leaks.

CAUTION: Do not use any leak dye in R-134a system or damage to system may result.

14.6.11 Use thread sealant on all male fitting threads (sparingly), staying off the first two (2) threads near sealing surface. A light coating of R-134a refrigerant oil must be applied to flare to prevent metal galling damage. (this is out of place)

14.6.12 Tighten joints as required to stop leaks. Reference Table I.

CAUTION: Do not over tighten plumbing connections, stripped threads or cracked flares may result. A small amount of oil may be used on threads to aid in achieving proper torque.

14.6.13 With system leak tight, turn off nitrogen source, disconnect yellow charging hose from source and slowly release nitrogen pressure to zero.

CAUTION: Vent system pressure very slowly to assure that compressor oil is not vented with the nitrogen. Do not let air enter the system.

14.6.14 Evacuate system to prepare for charging.

14.6.15 Close manifold valve.

15.0 SYSTEM EVACUATION AND CHARGING PROCEDURES

NOTE: If a previously charged system is low on refrigerant, the system should be checked for leaks.

NOTE: These instructions give procedures applicable to a manually operated refrigerant manifold/supply system. If automatic recovery/recycling/recharging equipment is used follow equipment manufacturer's recommendations.

NOTE: Air conditioner system charging should take place in an area where the helicopter can be run for final charge determination.

15.1 Evacuating The System

15.1.1 Connect the service manifold and vacuum pump to service fittings on compressor.

NOTE: Follow Vacuum Pump Manufacturer's recommendations for operation.

15.1.2 Turn on vacuum pump and open both valves to evacuate system. System absolute pressure, before charging, should be less than ½ in. Hg.

NOTE: Absolute pressure of ½ in Hg. corresponds to about 29.4 in. VACUUM at sea level. The corresponding VACUUM pressure will drop about 1.1 in. per thousand feet of elevation.

CAUTION: Do not let air enter the system. Assure that compressor oil is not evacuated from the system, replace any oil that is removed during this process.

15.1.3 When system evacuation is complete, first turn off both manifold valves. Then turn off the vacuum pump. Allow the system to set for 4 hours. If system vacuum does not remain constant, check all fittings and hoses for leaks.

15.2 Charging An Evacuated System

15.2.1 Fill charging cylinder with at least 2.75 lbs. of HFC-134a liquid. Plug in heater and wait until pressure in the cylinder reaches 150-200 psig.

- 15.2.2 Connect the charging cylinder to the service manifold. Open the valve on the charging cylinder. Loosen the charging line connector at the service manifold to purge air from the line. Re-tighten connector.
- 15.2.3 Open high-pressure valve at compressor discharge, on manifold, and watch for indication of pressure on low-pressure gage (this proves that the expansion valves are opening). Slowly open low-pressure valve to increase charging rate. Initial charge of 2.0 lb. is recommended.
- 15.2.4 Final charge determination should be accomplished with the helicopter running, and evaporators in operation. Close all valves before helicopter run up.
- 15.2.5 Use an electronic leak detector to check at each fitting assembly. If a leak is found, it must be corrected.

15.3 Determining Optimum Refrigerant Charge

- 15.3.1 Ground-run the helicopter at 100% N₂, and allow the air conditioning system to operate for 10 minutes to stabilize.

NOTE: Outside air temperature should be at least 75°F, and all doors should be left open.
- 15.3.2 Measure the difference between evaporator's inlet and outlet air temperatures after stabilization at initial charge.
- 15.3.3 Add a small amount of refrigerant, and allow the system to re-stabilize.
- 15.3.4 Re-measure the difference between evaporator's inlet and outlet air temperatures. At this time the difference in temperatures will probably have increased.
- 15.3.5 Repeat steps 15.3.2 through 15.3.4 until addition of refrigerant causes reduced temperature difference between inlet and outlet airflow. This indicates that optimum refrigerant charge has been exceeded.
- 15.3.6 Recover the refrigerant overcharge.
- 15.3.7 Close service manifold valves, and disconnect both service lines being careful to lose as little refrigerant as possible. Replace caps on service fittings.

15.4 Adding Refrigerant to an Existing Partial Charge:

- NOTE:** A partial system charge can be restored to "full charge" without discharging and evacuating the system. This procedure is described in this section.
- 15.4.1 Check for and correct/replace any hose or fitting leaks and replace any oil leaked from the system ref. paragraph 12.0 "System Lubrication".
- 15.4.2 Connect the manifold system to the refrigerant tank and to the service fittings. The connections at the service fittings should be loose.

- 15.4.3 Slowly open the tank valve and bleed air from between the tank and the service manifold, tighten fittings.
- 15.4.4 Slowly open the manifold valves, allowing refrigerant to purge the air from the lines.
- 15.4.5 Tighten the line fittings and close valves on manifold.
- 15.4.6 Follow procedure in section 15.3 to optimize refrigerant charge and remove the charging equipment.

CAUTION: Do not open the discharge valve to the refrigerant tank, to avoid tank rupture. Avoid drawing liquid refrigerant into compressor suction port. This may cause hydraulic lock and failure of compressor.

16.0 SYSTEM TROUBLE SHOOTING

- 16.1 Prior to troubleshooting a defective system, conduct a visual inspection for general condition. Check circuit breakers and fuses in system power circuits.
- 16.2 The following step-by-step procedure lists the easiest checks, and most likely problem sources first. Use this guide in conjunction with troubleshooting Table III and a ground power source.
 - 16.2.1 Electrical - Make sure evaporator blowers work in HI and LOW modes. Check that the condenser blower is working and that the compressor clutch is engaged. (Bypass Hi-Lo Switch to engage clutch).
 - 16.2.2 System Charge - Connect service manifold to service fittings and purge the air from the manifold lines. The static pressure should read approx. 57 psig (60°F, Sea Level) to 104 psig (90°F, Sea Level). Gage pressure increases by about ½ psi per thousand feet of altitude. Linear interpolation for expected pressure is acceptable. If the pressure is significantly lower than expected, the system may be leaking. The system should be checked with the compressor running. See paragraph 15.4. “Adding Refrigerant to an Existing Partial Charge.”
 - 16.2.3 Expansion Valve Malfunction - If the cooling loss is limited to only one evaporator it is most likely a defective expansion valve. Confirmation of an expansion valve (TXV) problem can be made by touching the valve during system operation. If the system pressures are correct, and the TXV is warm, the problem is in the valve.

Loss of cooling in all evaporators (assuming that there were no problems identified during previous steps), could be caused by refrigerant flow blockage at the expansion valves. This blockage could be due to ice or dirt, see paragraph 15.2. “Charging an Evacuated System”.
 - 16.2.4 Compressor Malfunction - When the compressor is running, HI/SIDE pressure should be in the range of 200 to 270 psig and LOW/SIDE pressure should be no more than about 40 psig. If the system will not maintain the pressure differential, and there are no system leaks, the problem could be a failed compressor, refer to the troubleshooting chart. The compressor may need replacement.

- 16.2.5 Dryer Bottle "HI-LO" Switch - If system charge falls below 28 psi or exceeds 384 psi the dryer bottle "HI-LO" switch will open and interrupt power to the compressor clutch. Reset values for the switch are 29 psi and 256 to 340 psi respectively. This indicates improper system charge. Refer to Charging Instructions for corrective action.

17.0 EVAPORATOR BALANCING PROCEDURE

NOTE: Evaporator balancing is required on all systems with multiple evaporator modules. This process balances refrigerant flow between evaporators to achieve equal evaporator air outlet temperatures.

CAUTION: Eye and hand protection should be worn during this operation.

- 17.1 Access all evaporator modules and measure/record outlet air temperatures.
- 17.2 Adjust the expansion valve on the evaporator with the highest outlet air temperature 1/4 revolution in a CW direction. This will increase the refrigerant flow and reduce the outlet air temperature.
- 17.3 Adjust the remaining evaporator(s) with a lower outlet air temperature ¼ revolution CCW.
- 17.4 Allow system to stabilize, recheck the evaporator outlet temperatures and repeat adjustment procedure if required. Evaporator outlet temperatures should be within 1-3°F of each other.

NOTE: Proper evaporator balancing should not result in a change of the compressor suction pressure. Verify system pressures are within values shown in Section 16.2.

- 17.5 If evaporator outlet temperatures are equal and suction pressure meets Section 16.2 servicing is complete. If not, repeat Sections 17.2 and 17.3, or refer to Troubleshooting Chart.
- 17.6 Shut system off and replace all shrouds, enclosures, ducting as required and remove charging manifold gauges and hose assembly.

18.0 EXPANSION VALVE ADJUSTMENT PROCEDURE

NOTE: Even though the automatic expansion valve is set at the factory there may be times when it must be adjusted to assure proper refrigerant flow at the desired evaporating temperature, due to excessive pressure drop for long suction line runs. Any adjustment must not affect desired suction and discharge pressures.

18.1 Special Tools and/or Equipment

18.1.1 The following tools and/or equipment are required to perform expansion valve adjustment:

18.1.1.1 Inspection mirror, adjustable.

18.1.1.2 Thermometer, 0-150°F.

18.1.1.3 Flashlight or service lamp.

18.1.1.4134a service manifold and gauge set.

18.1.1.5Hand tools.

18.2 Expansion Valve Adjustment

CAUTION: Eye and hand protection should be worn during this operation.

The expansion valve adjustment shall be performed in accordance with, but not limited to the following:

- 18.2.1 Verify that system leak check and refrigerant charging has been performed and system is operating satisfactorily.
- 18.2.2 Remove all shrouds, covers or enclosures, which prevent access to the evaporator expansion valve adjustment knob.
- 18.2.3 Remove expansion valve protective cap.
- 18.2.4 Verify that inlet to evaporator coil and blower ducting are free of any contamination or restrictions which could alter air flow.
- 18.2.5 Verify the blower speed switch is in the high position.
- 18.2.6 Verify R-134a manifold gauges and hoses are connected to the compressor service valves and system is operating normally.
- 18.2.7 With cabin doors open allow system to operate for 5 minutes.
- 18.2.8 Record compressor suction and discharge pressures and evaporator air inlet and outlet temperatures.
- 18.2.9 If suction pressure is higher than values outlined in Section 16.2 the expansion valves must be turned CCW in ½ revolution increments, waiting 2-5 minutes for valve to stabilize, until desired value is obtained and/or air outlet temperature is the lowest possible.
- 18.2.10 If suction pressure is lower than values outline in Section 16.2 the expansion valve must be turned CW in accordance with the same procedure previously discussed in this section.
- 18.2.11 Allow system to operate for 5-10 minutes after expansion valve adjustment to verify setting.
- 18.2.12 After satisfactory results have been achieved shut system off and replace all shrouds, enclosures, ducting as required and remove charging manifold gauges and hose assembly.

19.0 WARRANTY CONSIDERATIONS

Component warranty may be denied should any of the following conditions occur:

- 19.1 Component damage resulted from mishandling or negligence.
- 19.2 Component disassembled.
- 19.3 Component altered in configuration.
- 19.4 Component failure due to refrigerant system contamination or improper charge.
- 19.5 Component not serviced or maintained correctly.
- 19.6 Component out of warranty.
- 19.7 Component not returned in proper shipping container (use same container that the unit was shipped in).
- 19.8 Component repaired with parts not FAA/PMA or OEM approved.
- 19.9 Component ports not capped.
- 19.10 Component warranty claim not filed correctly.
- 19.11 Use of non-approved refrigerant oil.
- 19.12 Use of liquid dye leak check fluid.

TABLE I
TORQUE RECOMMENDATION

TUBE SIZE (IN.)	FITTING TORQUE (IN.-LB.) WITH SECO7 SEAL	FITTING TORQUE (IN.-LB.) WITHOUT SECO7 SEAL
1/4	40 - 60	132 - 180
3/8	75 - 115	216 - 300
1/2	150 - 225	432 - 540
5/8	200 - 315	642 - 765
3/4	300 - 450	852 - 1,164

TABLE II
PERIODIC INSPECTION SCHEDULE

ITEM	PRIOR TO COOLING SEASON	EVERY 100 HR OPERATION
Check Evap. Blower HI/LOW	X	X
Check Condenser Blower Operation	X	X
Belt Wear and Tension	X*	X*
Placards	X	
System Components for Security and Integrity of Mountings and Hardware	X	X
Compressor Mount for Cracks	X	X

* The belt tension on a newly installed belt should be reset after the first two hours of operation. Replace the belt based on condition. Reference the compressor installation section of this document.

TABLE III
TROUBLESHOOTING

There may be a time when the system does not operate and/or perform in accordance with information contained herein. Therefore, it is necessary for the service personnel to diagnose the discrepancy by troubleshooting the system and its components. To assist in this diagnosis the following troubleshooting list is provided.

INDICATION	PROBABLE CAUSE	POSSIBLE SOLUTION
A. No system power	<ol style="list-style-type: none"> 1. Gnd power not connected 2. Aircraft power switch off 	<ol style="list-style-type: none"> 1. Plug in gnd power cart 2. Energize power switch
B. Power on but system will not operate	<ol style="list-style-type: none"> 1. Air cond. CB off 2. Air cond. CB failed 3. Aircond. mode SW failed 4. Vented system 	<ol style="list-style-type: none"> 1. Energize aircond. CB 2. Replace 3. Replace 4. Evacuate and charge system
C. System operates but does not cool.	<ol style="list-style-type: none"> 1. Low refriger. Charge 2. Overcharged system cutout (Hi-Low Switch) 3. Failed compressor 4. Broken belt 5. Failed expansion valve(s) 6. Evap. blower switch(s) failed 7. Evap. blower(s) motor failed 8. Evap. blower(s) fuses blown 9. Evap. module air inlet clogged 10. TXV valve inlet clogged 11. Excessive moisture in system 12. Excessive oil in system 	<ol style="list-style-type: none"> 1. Charge as required 2. Reclaim refriger. overcharge as required 3. Replace 4. Replace 5. Replace 6. Replace 7. Replace 8. Replace 9. Remove debris 10. Remove debris 11. Replace dryer assy. 12. Drain excessive oil
D. Evaporator noisy	<ol style="list-style-type: none"> 1. Blower Wheel hitting scroll 2. Defective blower motor bearing 3. Air inlet clogged 	<ol style="list-style-type: none"> 1. Replace 2. Replace motor 3. Remove blockage
E. No low evap. fan speed (hi speed ok)	<ol style="list-style-type: none"> 1. Failed switch 2. Failed resistor 	<ol style="list-style-type: none"> 1. Replace 2. Replace
F. No evaporator(s) air flow	<ol style="list-style-type: none"> 1. C.B. off 2. C.B. failed 3. Mode SW failed 4. Fan speed SW failed 5. Seized motor(s) 6. Blower wheel failed 7. Blocked air outlet duct 8. Blocked air inlet duct 9. Aircraft power not on 10. Ground power not on 	<ol style="list-style-type: none"> 1. Turn on 2. Replace 3. Replace 4. Replace 5. Replace 6. Replace 7. Remove debris 8. Remove debris 9. Turn on 10. Turn on

TABLE III
TROUBLESHOOTING (Cont'd)

INDICATION	PROBABLE CAUSE	POSSIBLE SOLUTION
G. Evap. module coil(s) freezing	1. Expansion valve clogged with ice, debris or failed 2. Expansion valve setting low	1. Remove debris or replace Valve ref. 16.0 2. Ref. 18.0 for suction pressure adjustment
H. Pressure switch cycles (high press. Cutout)	1. System over charged 2. Cond. coil outlet air extremely hot 3. Cond. inlet clogged 4. Compressor discharge hose clogged or kinked 5. Excessively high ambient temperature	1. Reclaim excess refrig. 2. Normal condition with High O.A.T. 3. Remove debris 4. Replace hose 5. Normal condition
I. Compressor will not operate	1. C.B. failed or off 2. Hi-Lo pressure switch failed 3. Broken clutch power wire 4. Low refrigerant charge 5. Loose belt tension or broken belt 6. Clutch failure	1. Turn on or replace 2. Replace Hi-Lo switch 3. Replace wire 4. Re-charge system 5. Tighten or replace belt 6. Replace compressor
J. Drive Belt Failure	1. Worn or deteriorated belt 2. Improper belt tension 3. Poor belt alignment 4. System over charge 5. Compressor failure	1. Replace 2. Replace belt, follow correct belt tension procedure 3. Re-align compressor 4. Correct system charge 5. Replace
K. Condenser Fan will not run	1. No power to condenser 2. Fan motor failed 3. Poor ground 4. Broken power or ground wire	1. Turn on system power or C.B. 2. Replace fan assembly 3. Properly ground fan 4. Replace wire
L. Condenser Fan Noisy	1. Fan retainer clip broken 2. Exhaust screen bent or loose	1. Replace clip and damaged components 2. Replace or straighten screen

TABLE IV
WEIGHT AND BALANCE DATA

ITEM	WT. (LB).	F.S. (IN).	B.L. (IN).	RUNNING		
				WT (LB).	F.S. (IN).	B.L. (IN).
FORWARD EVAPORATORS	13.2	15.5	0.40	13.2	15.50	0.40
AFT. EVAPORATOR	7.5	162.6	-8.00	20.7	68.80	-2.64
DRYER BOTTLE	1.3	202.0	8.00	22.0	76.67	-2.01
CONDENSER INST'N.	12.3*	170.0	0.00	34.3	110.14	-1.29
INLET VENT INST'N	-0.9*	178.0	0.00	33.4	108.31	-1.33
COMPRESSOR ASSY.	16.4	188.0	-5.90	49.8	134.55	-2.83
COMPRESSOR BRKT	1.3	188.0	-5.90	51.1	135.91	-2.91
DRIVE PULLEY INST'N	0.7	191.0	0.00	51.8	136.66	-2.87
PLUMBING INST'N	8.1	106.6	0.00	59.9	132.59	-2.48
ELECTRICAL INST'N	1.5**	106.6**	0.00**	61.4	131.96	-2.42
REFRIGERANT	3.5**	128.0**	0.00**	64.9	131.74	-2.29
MISC. CLAMPS, FASTENERS	0.2**	106.6**	0.00**	65.1	131.67	-2.28

* Net Weight Addition

** Estimated, Overall Net

APPENDIX A

FLIGHT MANUAL SUPPLIMENT

APPENDIX B

SUPPLEMENTAL TYPE CERTIFICATE

APPENDIX C

PARKER PUBLICATION NO. 4400-B.1

PARKER SAFETY GUIDE

for Selecting and Using Hose, Fittings, and Related Accessories

Parker Safety Guide for Selecting and Using Hose, Fittings, and Related Accessories

Parker Publication No. 4400-B.1
Revised: April 1997

⚠ DANGER: Failure or improper selection or improper use of hose, fittings, or related accessories can cause death, personal injury and property damage. Possible consequences of failure or improper selection or improper use of hose, fittings, or related accessories include but are not limited to:

- Fittings thrown off at high speed.
- High velocity fluid discharge.
- Explosion or burning of the conveyed fluid.
- Electrocutation from high voltage electric power lines.
- Sparking or explosion while paint or flammable liquid spraying.
- Dangerously whipping hose.
- Contact with conveyed fluids that may be hot, cold, toxic or otherwise injurious.
- Sparking or explosion caused by static electricity buildup or other sources of electricity.
- Injections by high-pressure fluid discharge.
- Contact with suddenly moving or falling objects that are controlled by the conveyed fluid.

Before selecting or using any Parker hose or fittings or related accessories, it is important that you read and follow the instructions below.

1.0 GENERAL INSTRUCTIONS

- 1.1 Scope:** This safety guide provides instructions for selecting and using (including assembling, installing, and maintaining) hose (including all rubber and/or plastic products commonly called "hose" or "tubing"), fittings (including all products commonly called "fittings" or "couplings" for attachment to hose), and related accessories (including crimping and swaging machines and tooling). This safety guide is a supplement to and is to be used with, the specific Parker publications for the specific hose, fittings and related accessories that are being considered for use.
- 1.2 Fail-Safe:** Hose and hose assemblies can and do fail without warning for many reasons. Design all systems and equipment in a fail-safe mode, so that failure of the hose or hose assembly will not endanger persons or property.
- 1.3 Distribution:** Provide a copy of this safety guide to each person that is responsible for selecting or using hose and fitting products. Do not select or use hose and fittings without thoroughly reading and understanding this safety guide as well as the specific Parker publications for the products considered or selected.
- 1.4 User Responsibility:** Due to the wide variety of operating conditions and uses for hose and fittings, Parker and its distributors do not represent or warrant that any particular hose or fitting is suitable for any specific end use system. This safety guide does not analyze all technical parameters that must be considered in selecting a product. The user, through its own analysis and testing, is solely responsible for:
- Making the final selection of the hose and fitting.
 - Assuring that the users requirements are met and that the use presents no health or safety hazards.
 - Providing all appropriate health and safety warnings on the equipment on which the hose and fittings are used.
- 1.5 Additional Questions:** Call the appropriate Parker technical service department if you have any questions or require any additional information. See the Parker publication for the product being considered or used, for telephone numbers of the appropriate technical service department.

2.0 HOSE AND FITTING SELECTION INSTRUCTIONS

- 2.1 Electrical Conductivity:** Certain applications require that a hose be nonconductive to prevent electrical current flow. Other applications require the hose to be sufficiently conductive to drain off static electricity. Extreme care must be exercised when selecting hose and fittings for these or any other applications in which electrical conductivity or nonconductivity is a factor.
- For applications that require hose to be electrically nonconductive, including but not limited to applications near high voltage electric lines, only special nonconductive hose can be used. The manufacturer of the equipment in which the non-conductive hose is to be used must be consulted to be certain that the hose and fittings that are selected are proper for the application. Do not use any Parker hose or fitting for any such application requiring nonconductive hose, including but not limited to applications near high voltage electric lines, unless (i) the application is expressly approved in the Parker technical publication for the product, (ii) the hose is both orange color and marked "nonconductive," and (iii) the manufacturer of the equipment on which the hose is to be used specifically

approves the particular Parker hose and fitting for such use.

The electrical conductivity or nonconductivity of hose and fittings is dependent upon many factors and may be susceptible to change. These factors include but are not limited to the various materials used to make the hose and the fittings, manufacturing methods (including moisture control), how the fittings contact the hose, age and amount of deterioration of damage or other changes, moisture content of the hose at any particular time, and other factors.

Parker manufactures a special hose for conveying paint in airless paint spraying applications. This hose is labeled "Electrically Conductive Airless Paint Spray Hose" on its layline and on its packaging. This hose must be properly connected to Parker fittings and properly grounded in order to dissipate dangerous static charge buildup which occurs in all airless paint spraying. Do not use any other hose, even if electrically conductive, for airless paint spraying. Use of any other hose or failure to properly connect the hose can cause a fire or an explosion resulting in death, personal injury, and property damage.

Parker manufactures a special hose for certain compressed natural gas (CNG) applications where static electricity buildup may occur. Parker CNG hose assemblies comply with AGA Requirements 1-93, "Hoses for Natural Gas Vehicles and Fuel Dispensers". This hose is labeled "Electrically Conductive for CNG Use" on its layline and on its packaging. This hose must be properly connected to Parker fittings and properly grounded in order to dissipate dangerous static charge buildup which occurs in, for example, high velocity CNG dispensing or transfer. Do not use any other hose, even if electrically conductive, for CNG transfer where static charge buildup may occur. Use of any other hose in such application or failure to properly connect this hose can cause a fire or an explosion resulting in death, personal injury, and property damage. Care must also be taken to protect against dangerous gas permeation through the hose wall. See section 2.6, Permeation, for more information.

Parker CNG hose is intended for dispenser and vehicle use at maximum temperature of 180°F. Parker CNG hose should not be used in confined spaces or areas exceeding 180°F. Final Assemblies must be tested for leaks. **Caution:** Matches, candles, open flame or other sources of ignition shall not be used for this purpose. Leak check solutions should be rinsed off after use. Special care should be taken to ensure the hose is not kinked, twisted, torque, exposed to abusive environmental conditions specified in Section 2.9, or exceed the pressure requirements specified in Section 2.2, "Pressure". Hose assemblies should be tested on at least a monthly basis per Section 4.2 "Visual Inspection Hose/Fitting". Recommended procedures are to pressurize the hose and check for leaks and to visually inspect the hose for damage. Hose assemblies should be tested on a monthly basis for conductivity per AGA 1-93.

- 2.2 Pressure:** Hose selection must be made so that the published maximum recommended working pressure of the hose is equal to or greater than the maximum system pressure. Surge pressures in the system higher than the published maximum recommended working pressure will cause failure or shorten hose life. Do not confuse burst pressure or other pressure values with working pressure and do not use burst pressure or other pressure values for this purpose.

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- 2.3 Suction:** Hoses used for suction applications must be selected to insure that the hose will withstand the vacuum and pressure of the system. Improperly selected hose may collapse in suction application.
- 2.4 Temperature:** Be certain that fluid and ambient temperatures, both steady and transient, do not exceed the limitations of the hose. Temperatures below and above the recommended limit can degrade hose to a point where a failure may occur and release fluid. Care must be taken when routing hose near hot objects (e.g. manifolds) to properly insulate and protect the hose.
- 2.5 Fluid Compatibility:** Hose selection must assure compatibility of the hose tube, cover, reinforcement, and fittings with the fluid media used. See the fluid compatibility chart in the Parker publication for the product being considered or used. This information is offered only as a guide. Actual service life can only be determined by the end user by testing under all extreme conditions and other analysis.
- 2.6 Permeation:** Permeation (that is, seepage through the hose) will occur from inside the hose to outside when hose is used with gases, liquid and gas fuels, and refrigerants (including but not limited to such materials as helium, fuel oil, natural gas, or freon). This permeation may result in high concentrations of vapors which are potentially flammable, explosive, or toxic, and in loss of fluid. Dangerous explosions, fires, and other hazards can result when using the wrong hose for such applications. The system designer must take into account the fact that this permeation will take place and must not use hose if this permeation could be hazardous. The system designer must take into account all legal, government, insurance, or any other special regulations which govern the use of fuels and refrigerants. Never use a hose even though the fluid compatibility is acceptable without considering the potential hazardous effects that can result from permeation through the hose assembly.
- Permeation of moisture from outside the hose to inside the hose will also occur in hose assemblies, regardless of internal pressure. If this moisture permeation would have detrimental effects (particularly but not limited to refrigeration and air conditioning systems), incorporation of sufficient drying capacity in the system or other appropriate system safeguards should be selected and used.
- 2.7 Size:** Transmission of power by means of pressurized fluid varies with pressure and rate of flow. The size of the components must be adequate to keep pressure losses to a minimum and avoid damage due to heat generation or excessive fluid velocity.
- 2.8 Routing:** Attention must be given to optimum routing to minimize inherent problems (kinking or flow restriction due to hose collapse).
- 2.9 Environment:** Care must be taken to insure that the hose and fittings are either compatible with or protected from the environment (that is, surrounding conditions) to which they are exposed. Environmental conditions including but not limited to ultraviolet radiation, sunlight, heat, ozone, moisture, water, salt water, chemicals, and air pollutants can cause degradation and premature failure.
- 2.10 Mechanical Loads:** External forces can significantly reduce hose life or cause failure. Mechanical loads which must be considered include excessive flexing, twist, kinking, tensile or side loads, bend radius, and vibration. Use of swivel type fittings or adapters may be required to insure no twist is put into the hose. Unusual applications may require special testing prior to hose selection.
- 2.11 Physical Damage:** Care must be taken to protect hose from wear, snagging and cutting, which can cause premature hose failure.
- 2.12 Proper End Fitting:** See instructions 3.2 through 3.5 below. These recommendations may be substantiated by testing to industry standards such as SAE J517.
- 2.13 Length:** When establishing a proper hose length, motion absorption, hose length changes due to pressure, and hose and machine tolerances must be considered.
- 2.14 Specifications and Standards:** When selecting hose and fittings, government, industry, and Parker specifications and recommendations must be reviewed and followed as applicable.
- 2.15 Hose Cleanliness:** Hose components may vary in cleanliness levels. Care must be taken to insure that the assembly selected has an adequate level of cleanliness for the application.
- 2.16 Fire Resistant Fluids:** Some fire resistant fluids require the same hose as petroleum oil. Some use a special hose, while a few fluids will not work with any hose at all. See instructions 2.5 and 1.5. The wrong hose may fail after a very short service. In addition, all liquids but pure water may burn fiercely under certain conditions, and even pure water leakage may be hazardous.
- 2.17 Radiant Heat:** Hose can be heated to destruction without contact by such nearby items as hot manifolds or molten metal. The same heat source may then initiate a fire. This can occur despite the presence of cool air around the hose.
- 2.18 Welding or Brazing:** When using a torch or arc-welder in close proximity to hydraulic lines, the hydraulic lines should be removed or shielded with appropriate fire resistant materials. Flame or weld spatter could burn through the hose and possibly ignite escaping fluid resulting in a catastrophic failure. Heating of plated parts, including hose fittings and adapters, above 450°F (232°C) such as during welding, brazing, or soldering may emit deadly gases.
- 2.19 Atomic Radiation:** Atomic radiation affects all materials used in hose assemblies. Since the long term effects may be unknown, do not expose hose assemblies to atomic radiation.
- 3.0 HOSE AND FITTING ASSEMBLY AND INSTALLATION INSTRUCTIONS**
- 3.1 Pre-Installation Inspection:** Prior to installation, a careful examination of the hose must be performed. All components must be checked for correct style, size, catalog number, and length. In addition, the hose must be examined for cleanliness, obstructions, blisters, cover looseness, or any other visible defects.
- 3.2 Hose and Fitting Assembly:** Do not assemble a Parker fitting on a Parker hose that is not specifically listed by Parker for that fitting unless authorized in writing by the chief engineer of the appropriate Parker division. Do not assemble a Parker fitting on another manufacturer's hose or a Parker hose on another manufacturer's fitting unless (i) the chief engineer of the appropriate Parker division approves the assembly in writing, and (ii) the user verifies the assembly and the application through analysis and testing. See instruction 1.4 above.
- The Parker published instructions must be followed for assembling the fittings on the hose. These instructions are provided in the Parker fitting catalog for the specific Parker fitting being used.
- 3.3 Related Accessories:** Do not crimp or swage any Parker hose or fitting with anything but the proper listed Parker swage or crimp machine and dies and in accordance with Parker published instructions. Do not crimp or swage another manufacturer's hose fitting with a Parker crimp or swage die unless authorized in writing by the chief engineer of the appropriate Parker division.
- 3.4 Parts:** Do not use any Parker hose fitting part (including but not limited to socket, shell, nipple, or insert) except with the correct Parker mating parts, in accordance with Parker published instructions, unless authorized in writing by the chief engineer of the appropriate Parker division.
- 3.5 Reusable/Permanent:** Do not reuse any reusable hose product that has blown or pulled off a hose. Do not reuse a Parker permanent (that is, crimped or swaged) hose fitting or any part thereof.
- 3.6 Minimum Bend Radius:** Installation of a hose at less than the minimum listed bend radius may significantly reduce the hose life. Particular attention must be given to preclude sharp bending at the hose/fitting juncture.
- 3.7 Twist Angle and Orientation:** Hose installations must be such that relative motion of machine components does not produce twisting.
- 3.8 Securement:** In many applications, it may be necessary to restrain, protect, or guide the hose to protect it from damage by unnecessary flexing, pressure surges, and contact with other mechanical components. Care must be taken to insure such restraints do not introduce additional stress or wear points.
- 3.9 Proper Connection of Ports:** Proper physical installation of the hose requires a correctly installed port connection insuring that no twist or torque is transferred to the hose.
- 3.10 External Damage:** Proper installation is not complete without insuring that tensile loads, side loads, kinking, flattening, potential abrasion, thread damage, or damage to sealing surfaces are corrected or eliminated. See instruction 2.10.
- 3.11 System Checkout:** All air entrapment must be eliminated and the system pressurized to the maximum system pressure and checked for proper function and freedom from leaks. Personnel must stay out of potential hazardous areas while testing and using.
- 3.12 Routing:** Hose should be routed in such a manner so if a failure does occur, oil mist will not come into contact with hot surfaces, open flame, or sparks, and the chance of personal injury is minimized.

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4.0 HOSE AND FITTING MAINTENANCE INSTRUCTIONS

- 4.1 Even with proper selection and installation, hose life may be significantly reduced without a continuing maintenance program. Frequency should be determined by the severity of the application and risk potential. A maintenance program must be established and followed by the user and, at minimum, must include instructions 4.2 through 4.7, listed below.
- 4.2 **Visual Inspection Hose/Fitting:** Any of the following conditions require immediate shut down and replacement of the hose assembly:
- Fitting slippage on hose;
 - Damaged, cut or abraded cover (any reinforcement exposed);
 - Hard, stiff, heat cracked, or charred hose;
 - Cracked, damaged, or badly corroded fittings;
 - Leaks at fitting or in hose;
 - Kinked, crushed, flattened or twisted hose; and
 - Blistered, soft, degraded, or loose cover.
- 4.3 **Visual Inspection All Other:** The following items must be tightened, repaired or replaced as required:
- Leaking port conditions;
 - Remove excess dirt buildup;
 - Clamps, guards, shields; and
 - System fluid level, fluid type and any air entrapment.
- 4.4 **Functional Test:** Operate the system at maximum operating pressure and check for possible malfunctions and freedom from leaks. Personnel must avoid potential hazardous areas while testing and using the system.
- 4.5 **Replacement Intervals:** Specific replacement intervals must be considered based on previous service life, government or industry recommendations, or when failures could result in unacceptable downtime, damage, or injury risk. See instructions 1.2 above.
- 4.6 **Inspecting a Pressurized System:** Hydraulic power is accomplished by utilizing high-pressure fluids to do work. Hoses, fittings, and hose assemblies all contribute to doing work by transmitting fluids at high pressures. Fluids under pressure can be dangerous and potentially lethal and, therefore, extreme caution must be exercised when working with fluids

under pressure and handling the hoses transporting the fluids. From time to time, hose assemblies will fail. Usually these failures are the result of some form of misapplication, abuse, or simply wear. When hoses fail, generally the high-pressure fluids inside escape in some sort of stream which may or may not be visible to the user. Under no circumstances should the user attempt to locate the leak by "feeling" with their hands or any other part of their body. High-pressure fluids can and will penetrate the skin and cause severe tissue damage and possibly loss of limb. Even seemingly minor hydraulic fluid injection injuries must be treated by a physician with knowledge of the tissue damaging properties of hydraulic fluid.

If a hose failure occurs, immediately shut down the equipment and leave the area until pressure has been completely released from the hose assembly. Simply shutting down the hydraulic pump may or may not eliminate the pressure in the hose assembly. Many times check valves, etc., are employed in a system and can cause pressure to remain in a hose assembly even when pumps or equipment are not operating. Tiny holes in the hose, commonly known as pinholes, can eject small, dangerously powerful but hard to see streams of hydraulic fluid. It may take several minutes or even hours for the pressure to be relieved so that the hose assembly may be examined safely.

Once the pressure has been reduced to zero, the hose assembly may be taken off the equipment and examined. It must always be replaced if a failure has occurred. Never attempt to patch or repair a hose assembly that has failed. Consult the nearest Parker distributor or the appropriate Parker division for hose assembly replacement information.

Never touch or examine a failed hose assembly unless it is obvious that the hose no longer contains fluid under pressure. The high-pressure fluid is extremely dangerous and can cause serious and potentially fatal injury.

- 4.7 **Refrigerant gases:** Special care should be taken when working with refrigeration systems. Sudden escape of refrigerant gases can cause blindness if the escaping gases contact the eye and can cause freezing or other severe injuries if it contacts any other portion of the body.