KEITH PRODUCTS, L.P.

Maintenance Manual with Illustrated Parts Catalog

Air-Conditioning System
Eurocopter EC120
Document No. CR-120-10

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RECORD OF REVISIONS

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A	02/01/05	Added troubleshooting for Pressure/Freeze Switch and Blower Motor to A/C System Troubleshooting Table's last four rows in Section 1 pg. 107. Added 21-51-96 to all page footers. Edited Section Numbering System on all pages. WAS 21-50-00 NOW 1; WAS 21-50-01 NOW 2; WAS 21-50-02 NOW 3; WAS 21-50-03 NOW 4 WAS 21-50-05 NOW 6. Added • System Under pressure in Probable Cause on pg. 106 Section 1. Added (System over pressure) under Probable Cause column pg. 106 Section 1. Added "by immersing in ice water" in Corrective column pg. 106 Section 1. Added "adjust charge" to Corrective Action column on pg. 106 Section 1. Added "with 900gr ± 50gr of R134a in" and (Ref TSC215A0103F01) to pg. 305 Section 1.C.4 Added Paragraph C. on pg. 102 Section 2. Added Paragraph B. under Blower Troubleshooting Procedures pg. 102 Section 2. Reason: Customer Request per ER2725	LEO	TD
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LIST OF SERVICE BULLETINS

SB No.	DATE	SUBJECT	REV	DATE INCORP.
SB202	7/19/06	Air Diffuser & Evaporator Assy.	D	

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INTRODUCTION

1. PURPOSE

The purpose of this Maintenance Manual is to provide detailed instructions for the servicing, troubleshooting, checking and maintaining of the Keith Products, L.P. air-conditioning system for the Eurocopter Model EC120 helicopter.

2. SCOPE

The scope of the Maintenance Manual provides the maintenance technician with detailed information covering:

- Overall system level description and theory of operation.
- Component level description and theory of operation.
- System level checking and troubleshooting procedures.
- Procedures for servicing the air-conditioning system refrigerant.
- The identification of special equipment to accomplish the specific tasks.
- An Illustrated Parts Catalog (IPC) covering the breakdown of each major component of the air-conditioning system including part numbers and diagrams.

3. GLOSSARY

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

A/C	-	Air-Conditioning
A/R	-	As Required
Assy	-	Assembly
Comm. Avail.	-	Commercially Available
Evap	-	Evaporator
Gnd	-	Ground
GPU	-	Ground Power Unit
VDC	-	Volts Direct Current

4. MANUAL UPDATES

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AIR-CONDITIONING SYSTEM

SYSTEM DESCRIPTION

1. GENERAL

The air conditioning system for the EC120 helicopter consists of a refrigerant R134a vapor cycle cooling system. This system allows the pilot to control cooling for a comfortable aircraft cabin. Figure 1, on Page 3, shows a general arrangement of a vapor cycle air conditioning system.

2. SYSTEM DESCRIPTION

The refrigeration or air conditioning system, as designed and manufactured by Keith Products for the Eurocopter EC120 helicopter, is a vapor cycle type cooling system using refrigerant R134a. The cabin blower is electrically operated using the aircraft 28 VDC electrical system and is operable in all normal flight modes. The air-conditioning system requires engine operation to power the compressor for cooling.

The major components of the system are the compressor assembly including the pressure switch, condenser assembly including the receiver/drier bottle, evaporator assembly including the expansion valve and freeze switch, the blower assembly and hose assemblies. Refrigerant plumbing and electrical systems connect the major components to provide a closed loop system.

The compressor assembly is located above the engine driven cooling fan and is belt driven from the fan. The compressor takes the low-pressure low-temperature refrigerant gas and compresses it to a high-pressure high-temperature gas.

The condenser assembly is located between the cooling fan and oil cooler. Cooling air is passed over the condenser coils, which removes heat from refrigerant, and is then exhausted overboard. The condenser takes the high-pressure high-temperature refrigerant gas and condenses it to a high-pressure medium-temperature liquid. The receiver/drier bottle is located on the condenser assembly. The receiver/drier bottle removes moisture from the refrigerant and stores refrigerant.

The evaporator assembly and blower assembly are located above the cabin. The blower provides cooling airflow for the cockpit and the cabin overhead air outlets. It can be operated in the A/C mode for cooling or FAN mode to provide air circulation without cooling. An independent variable fan speed control potentiometer is located on the A/C switch panel. The evaporator assembly thermal expansion valve regulates the amount of refrigerant into the evaporator coil to provide the optimum

cooling effect. The expansion valve takes the high-pressure medium temperature liquid refrigerant and lets it expand into a low-pressure low-temperature liquid. The refrigerant then removes heat from the air and boils into a low-pressure high-temperature gas. This re-circulating system continues to dry and cool the air each time it passes through the evaporator. Moisture removed from the air by the cold coil (condensate) is collected within the evaporator housing and is drained overboard. Located on the evaporator is a freeze switch, which will disengage the compressor clutch to prevent the evaporator from excessively low temperatures and ice formation.

The plumbing, which connects the compressor, condenser and evaporator, consists of rubber-based hoses with a nylon barrier. The fittings are permanently swaged onto the hoses. All fittings are “O-ring” type connections with sealant on the fitting mating surfaces to prevent refrigerant leaks. Two R134a service valves are located on the hose assemblies. They are sized differently to avoid cross connecting when gaining access to the plumbing for system servicing.

The entire air conditioning refrigerant loop is protected against over pressure conditions by two separate safety devices. The first device is a binary high/low pressure switch, located on the compressor discharge port that activates in the event of an overpressure. This switch will open at approximately 384.0 $\pm$ 28.4 PSI (2647.6 $\pm$ 195.8 KPa) and will interrupt power to the compressor clutch. The refrigerant system pressure will then drop. The switch will also interrupt power to the compressor clutch under low-pressure conditions. The second overpressure safety device is a fuse plug, which will vent the system refrigerant safely overboard in the event of a system over temperature in excess of 217-241°F (102.7-116.1°C). It is located on the receiver/drier bottle.

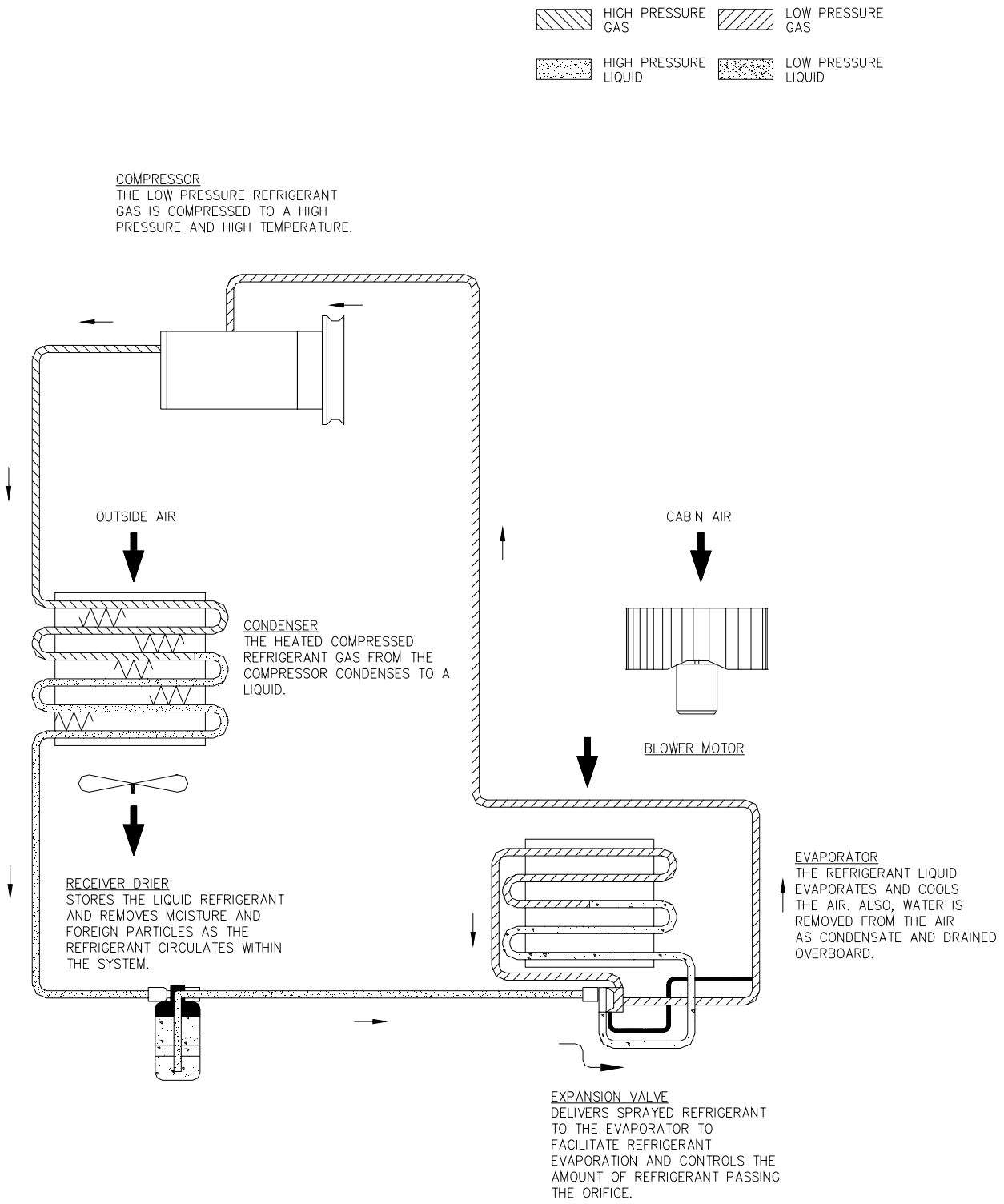


Figure 1
A/C Vapor Cycle System

AIR-CONDITIONING SYSTEM

TROUBLESHOOTING

1. GENERAL

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

A. MEASURING TEMPERATURE DROP ACROSS THE EVAPORATOR

Trying to associate a specific temperature drop across the evaporator is dependent on many factors such as inlet air temperature, moisture content (relative humidity) and airflow. On a day with extreme humidity, up to 70% of the evaporator capacity will go towards dehumidification (Latent Heat). That only leaves 30% available to actually lower the air temperature (Sensible Heat). A mechanic encountering this scenario may assume that because he can only measure a 10°F (5.6°C) drop in temperature that the system is not operating properly. This assumption is incorrect because he is not considering the amount of work it takes to condense moisture in the air and convert it to water that pours out of the condensate drain. To further complicate the issue if you eliminate the source of this humidity by closing the cabin door, your initial temperature readings will have a smaller temperature drop than measurements taken later. This is because you are drying out the air in the cabin and the evaporator is allowed to remove more sensible heat.

B. MEASURING SUCTION AND DISCHARGE PRESSURES

The most accurate method to start diagnosing the system is to start with checking the pressures. However you must remember that these pressures are affected by many different conditions such as outside air temperature, cabin temperature, cabin humidity and charge level. It is impossible to give an accurate head pressure at a specific temperature with out knowing these other factors. These pressures can even vary during the trouble shooting process, as the system continues to run you are removing heat from the cabin and lowering the cabin temperature. This lowered heat load will result in lower suction and discharge pressures.

C. SYSTEM DIAGNOSIS

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

Compressor

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

Condenser

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

Receiver/Drier

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

Expansion Valve

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

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

This bulb attaches to the suction line where the refrigerant exits the evaporator. It measures the temperature of this line. If there is insufficient refrigerant flowing

through the evaporator the gas will be warmer than desired (superheated). This in turn will warm the sense bulb, therefore expanding the gas within and exerting pressure on the diaphragm. The diaphragm will then move the metering pin and increase the flow of refrigerant to the evaporator. With the increased flow of refrigerant, the gas temperature exiting the evaporator will be reduced, therefore cooling the sense bulb, which lowers the pressure within and reduces the pressure exerted on the diaphragm. The diaphragm will then move the metering pin to reduce the refrigerant flow. The valve will make adjustments until a balance has been reached. *One of the most common problems associated with expansion valves is a bad attachment of the sense bulb. It must make contact along its entire length and be securely attached to the metallic suction tube exiting the evaporator case. It must be thoroughly insulated with foam tape to ensure that outside air does not affect its reading.*

2. TROUBLESHOOTING

Reference the air conditioning system-troubleshooting table.
(This section will deal with trouble shooting the refrigeration circuit only. It will not cover the obvious, such as failed blowers.)

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

Step one

Install gage set to the service ports. Turn on the system and allow it to stabilize for ten minutes. Observe suction and discharge pressures and temperatures across evaporator(s). If the evaporator does not have an adequate temperature drop or you suspect a loss of refrigerant charge, stop the system and evacuate and recharge to the prescribed weight of refrigerant R134a. With the system charged to the required weight you have now eliminated the possibility of an overcharged or undercharged system as being the cause of the problem.

Step Two

Turn the system on and allow it to stabilize for ten minutes. Check the suction and discharge pressures. A normal pressure reading for the suction side should be between 25 PSI (172.4 KPa) and 40 PSI (275.8 KPa). Remember this is dependent on OAT and evaporator heat load. The discharge pressure should be between 150 PSI (1034.2 KPa) and 300 PSI (2068.4 KPa). This is also dependent on OAT and evaporator heat load.

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

The expansion valve is the brain of the system. It controls how much liquid refrigerant is released into the evaporator coil. When this component fails it is important to understand the different ways it can fail and the associated symptoms.

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

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

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

3. AIR-CONDITIONING SYSTEM TROUBLESHOOTING TABLE

SERVICE PRESSURE GAUGE READING	CONDITION	PROBABLE CAUSE	CORRECTIVE ACTION
• Suction pressure: below normal. • Discharge pressure: below normal.	Insufficient Refrigerant Charge: • Insufficient cooling, bubbles appear in sight glass.	• Refrigerant is low or leaking a little.	• Leak test. • Repair leak. • Charge system. • Evacuate as necessary and recharge system.
• Suction pressure: much below normal • Discharge pressure: much below normal.	Almost No Refrigerant: • No cooling action. A lot of bubbles, or something like mist, appears in sight glass.	• Serious refrigerant leak.	• Stop compressor immediately. • Leak test. • Discharge system. • Repair leak(s). • Replace receiver drier, if necessary. • Check system oil level. • Evacuate and recharge system.
• Suction pressure: above normal. • Discharge Pressure: above normal.	Air In System: • Insufficient cooling. • Sight glass shows occasional bubbles.	• Air mixed with refrigerant in system.	• Discharge system. • Replace receiver drier. • Evacuate and charge system.
• Suction pressure: below normal. • Discharge pressure: above normal.	Moisture In System: • After operation for a while, pressure on suction side may show vacuum pressure reading. During this condition, discharge air will be warm. As warning of this, reading shows approximately 6-psi oscillation.	• Drier is saturated with moisture. Moisture has frozen at expansion valve. Refrigerant flow is restricted.	• Discharge system. • Replace receiver drier (twice if necessary). • Evacuate system completely. (Repeat 30 minute evacuating three times.) • Recharge system.

SERVICE PRESSURE GAUGE READING	CONDITION	PROBABLE CAUSE	CORRECTIVE ACTION
	Faulty Expansion Valve:		
• Suction pressure: below normal. • Discharge pressure: below normal.	• Slight cooling. Sweating or frosted expansion valve outlet.	• Expansion valve restricts refrigerant. • Expansion valve is clogged. • Valve is stuck closed. Thermal bulb has lost charge. • System undercharged	• Replace expansion valve.
• Suction pressure: above normal. • Discharge pressure: above normal.	• Insufficient cooling. Sweated suction line.	• Expansion valve allows too much refrigerant through evaporator. Sensing bulb on suction line not well insulated or properly attached to line (System overcharged).	• Check valve for operation by immersion in ice bath. If suction side does not show a pressure decrease, replace valve. • Check security and insulation on sensing bulb and adjust charge.
• Suction pressure: above normal. • Discharge pressure: below normal.	• No cooling. Sweating or frosted suction line.	• Faulty expansion valve. (Valve Flooded)	• Discharge system. • Replace valve. • Evacuate and recharge system.
	Faulty Condenser:		
• Suction pressure: above normal. • Discharge pressure: above normal.	• Insufficient cooling. • Suction line is very hot.	• Condenser air or refrigerant flow is restricted.	• Check condenser for dirt accumulation. • Check for refrigerant overcharge. • If pressure remains high in spite of all above actions taken, remove and inspect the condenser for possible oil clogging.

SERVICE PRESSURE GAUGE READING	CONDITION	PROBABLE CAUSE	CORRECTIVE ACTION
• Suction pressure: much below normal. • Discharge pressure: much above normal.	High Pressure Line Blocked: • Insufficient cooling. • Frosted high-pressure liquid line.	• Drier clogged, or restriction in high-pressure line.	• Discharge system. • Remove receiver drier and replace it. • Evacuate and charge system.
• Suction pressure: much below normal. • Discharge pressure: much below normal.	Faulty Compressor: • Insufficient cooling.	• Internal problem in compressor, or damaged gasket and valve.	• Discharge system. • Remove and check compressor. • Repair or replace compressor. • Check oil level. • Replace receiver drier. • Evacuate and charge system.
• Suction pressure: above normal. • Discharge pressure: above normal.	Too Much Oil In System: • Insufficient cooling.	• Too much oil circulates with refrigerant, causing the cooling capacity of the system to be reduced.	• Refer to “oil level check” for correcting oil level.
• N/A	Blower fails to operate	• Blower failure/Brush Failure • Circuit breaker tripped	• Check brush length • Check circuit breaker to the cabin blower.
• Suction pressure equals discharge pressure.	Faulty Pressure/Freeze Switch • No cooling	• Pressure/Freeze switch stuck open.	• Temporarily bypass switch to verify it is the problem. Replace as necessary.

SERVICE PRESSURE GAUGE READING	CONDITION	PROBABLE CAUSE	CORRECTIVE ACTION
• N/A	Faulty Freeze Switch • Low airflow	• Evaporator freezing restricting airflow.	• Adjust/Replace freeze switch.
• N/A	Faulty Pressure Switch • Loss of refrigerant/Drier bottle blow out disk has opened.	• Faulty pressure switch.	• Replace pressure switch and drier bottle and determine cause of over pressure.

AIR-CONDITIONING SYSTEM

SYSTEM SERVICING

1. REFRIGERANT SERVICING

The air conditioning system uses refrigerant R134a and the compressor lubricating oil used is Polyolester Oil viscosity grade ISO 68. No other refrigerant or compressor oil should be used.

Refrigerant R134a 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 personnel and property when working with R134a refrigerant.

WARNING:

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

B. Always wear safety goggles when servicing any part of the refrigerant system to prevent refrigerant from coming into contact with the eyes.

C. To avoid explosion, never weld, use a blow torch, solder, steam clean, or use excessive amounts of heat on, or in, the immediate area of the air conditioning system, or refrigerant supply tank, full or empty, while they are closed to atmosphere.

D. The refrigerant service cart/container has a safe strength. However, if handled incorrectly, it will explode. Therefore, always follow the instructions on the label. In particular, never store it in a hot location (above 126ºF, 52ºC) or drop it.

CAUTION: Do not operate air conditioning system with condenser air inlet or outlet blocked.

2. CHARGING EQUIPMENT

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

During the refrigerant recovery process, some oil is removed from the system with the refrigerant. This oil will be separated from the refrigerant by the recovery machine and drained to a special container. The containers are graduated in ounces or milliliters so you can view the amount of oil removed. Record the amount of oil because the same amount of new oil will need to be added back to the system prior to charging. It is critical that only polyolester oil (POE) is used. Mixing automotive (PAG) type oils will cause contamination and system failure. It is recommended that oil only be added to the discharge side of the system prior to charging. *Note: If oil is added to the suction side of the system it is possible that on start up oil can be sucked into the compressor and because it is non compressible it can damage or destroy the compressor*.

It is best to add the oil after the system has been evacuated to 29.9 in hg. This will allow the vacuum to suck the oil into the system then add the appropriate charge through the discharge service valve only. This will ensure oil is distributed through the system prior to start up. Most charging carts have the provisions to add oil without breaking into the system. *Note: ensure that there is an adequate amount of oil in the charging bottle and there no air bubbles in the standpipe.*

If your cart does not have this feature you can add oil in the following manner. After recovering the refrigerant and prior to evacuation, remove the discharge fitting from the compressor and pour the required amount into the line. Reconnect the fitting to the compressor. Evacuate the system through the low side only to prevent oil from being sucked out by the vacuum pump. Add the appropriate charge through the discharge service valve only. This will ensure oil is distributed through the system prior to start up.

3. DISCHARGING SYSTEM

A. GENERAL

The air conditioning system refrigerant must be discharged prior to disconnecting or removing and components in the refrigerant loop. Federal law prohibits discharging refrigerant into the atmosphere. Use only an R134a compatible recycling/recovery unit when discharging the air conditioning system.

B. TOOLS AND EQUIPMENT

Designation	Ref. No.	Qty	Remarks
Service Pressure Gauge	Comm. Avail.	1	None
R134a Compatible Recycling/Recovery Unit	Comm. Avail.	1	None

C. DISCHARGING PROCEDURES

1. Connect R134a compatible recycling/recovery unit to the R134a service valves on the aircraft's air conditioning system. If recovery unit does not have pressure gauges, connect service pressure to air conditioning system.

2. Operate air conditioning system for 10 minutes. This will collect as much oil as possible in the compressor.

3. Turn off the air conditioning system and take note of oil level on the refrigerant servicing cart.

4. Discharge the air conditioning system in accordance with the recovery unit's instructions.

5. Note the amount of compressor oil removed from the system during discharging. This amount of oil will have to be added back to the system during charging.

6. Remove recovery unit when discharging is complete.

4. EVACUATING SYSTEM

A. GENERAL

The air conditioning system must be evacuated prior to charging the system with refrigerant. Evacuating the system removes any moisture that may be in the system. Use only an R134a compatible recycling/recovery unit when evacuating the air conditioning system.

B. TOOLS AND EQUIPMENT

Designation	Ref. No.	Qty	Remarks
Service Pressure Gauge	Comm. Avail.	1	None
R134a Compatible Recycling/Recovery Unit	Comm. Avail.	1	None

C. EVACUATING PROCEDURE

NOTE: If charging cart does not have provisions for adding oil to the system, it will be necessary to add oil to the system by disconnecting the compressor discharge line and pouring the required quantity of polyolester ISO 68 oil in the line prior to evacuating the system. If this method is used evacuate the system through the suction side only to prevent oil from being sucked out through the vacuum pump.

1. Connect R134a compatible recycling/recovery unit to the R134a service valves on the aircraft's air conditioning system. If recovery unit does not have pressure gauges, connect service pressure to air conditioning system.

2. Evacuate the air conditioning system in accordance with the recovery unit's instructions for a minimum of 15 minutes at 29.9 in-Hg.

3. Once the air conditioning system has been evacuated, it is then ready for charging with new/recycled R134a refrigerant.

5. CHARGING SYSTEM

A. GENERAL

Use only new or recycled R134a refrigerant when charging air conditioning system. Federal law prohibits discharging refrigerant into the atmosphere. Use only R134a compatible recycling/recovery unit when charging the air conditioning system.

B. TOOLS AND EQUIPMENT

Designation	Ref. No.	Qty	Remarks
Service Pressure Gauge	Comm. Avail.	1	None
R134a Compatible Recycling/Recovery Unit	Comm. Avail.	1	None

C. CHARGING PROCEDURE

1. Connect R134a compatible recycling/recovery unit to the R134a service valves on the aircraft's air conditioning system.

2. Evacuate system prior to charging per Section 1 System Servicing.

3. Add the amount of compressor oil removed from the system during discharging. Add only polyolester oil, viscosity ISO 68.

   Warning: Adding oil to the low pressure side could result in compressor damage upon system startup. Always close off the low side of the recovery/recycling unit during charging.

4. Charge the air conditioning system with 900gr ± 50gr of R134a in accordance with the recovery unit's instructions or until the sight glass just clears of bubbles, with new or recycled R134a refrigerant (Ref. TSC215A0103F01).

5. Remove recovery unit when charging is complete.

AIR-CONDITIONING SYSTEM

INSPECTION

1. GENERAL

Listed below are the recommended inspections and inspection intervals for maintenance critical items associated with the air-conditioning system. Proper and timely inspections will keep the air conditioning system operating at its peak efficiency.

2. TOOLS AND EQUIPMENT

Designation	Ref. No.	Qty	Remarks
Service Pressure Gauge	Comm. Avail.	1	None
Electronic Leak Detector	N/A	A/R	R134a Compatible

3. INSPECTION INTERVALS

ITEM	INSPECT FOR	INTERVAL	ACTION
Air-Conditioning System Components	Dirt and damage	On condition or every 800 flight hours.	Clean or replace components as necessary.
Compressor Belt	Tension and wear	Within five (5) hours of installing a new belt, then every 400 flight hours.	Tension or replace as necessary per maintenance manual.
Sight Glass	Proper refrigerant level	When problem is suspected.	Discharge/Charge as necessary per maintenance manual.
Evaporator and Condenser Coils	Dirt	Aircraft Periodical Inspection (800 FH / 2 years)	Clean as necessary per maintenance manual.
Refrigerant Hoses	Chafing and wear	Aircraft Periodical Inspection (800 FH / 2 years)	Replace components as necessary.
Evaporator Blower Motor	N/A	1000 Operating Hours	Overhaul

4. INSPECTION PROCEDURES

A. Refrigerant Level Inspection

To be accomplished only when a refrigerant level problem is suspected.

1. Run the air-conditioning system for five minutes.

2. Check that the receiver/drier bottle inlet and outlet temperatures are the same. If the outlet temperature is considerably colder, then the receiver/drier bottle screen may be clogged and need replacement.

3. Check the sight glass for bubbles. No bubbles should be visible after five (5) minutes of operation.

NOTE: The refrigerant bubbles are more difficult to see at ambient temperatures below 65°F/18°C. Always recheck refrigerant level when ambient temperatures are above 65°F/18°C for proper level.

4. Add or remove refrigerant as required per Section 1 System Servicing.

B. Refrigerant Leak Inspection

To be accomplished only when a refrigerant leak problem is suspected.

1. The system leakage check is to be conducted in an area with ambient temperatures above 65°F/18°C.

2. On systems that have not been operated for more than two weeks, run the air-conditioning system for a minimum of ten minutes then turn the system off. This will lubricate the compressor shaft seal and provide a more accurate leakage check of the shaft seal.

3. Connect the pressure gauge set to the air-conditioning system and verify that they are reading the proper static pressure. Both gauges should read approximately 55 PSIG (372 Kpa) at standard temperature (59°F/15°C) with a properly charged system when the system is not operating.

4. With the leak detection equipment check all connections, compressor shaft seal, and air-conditioning components for leakage. No leakage is acceptable.

C. Compressor Oil Check

1. Check per Section 4 Maintenance Practices.

EVAPORATOR & BLOWER

DESCRIPTION AND OPERATION

1. GENERAL

The evaporator assembly is located above the cabin on the left hand side and includes an evaporator coil, expansion valve and freeze switch. The blower assembly is located above the cabin on the right hand side.

This section of the maintenance manual discusses troubleshooting and maintenance practices used for the evaporator assembly and blower assembly portion of the air conditioning system.

EVAPORATOR & BLOWER

TROUBLESHOOTING

1. GENERAL

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

2. TOOLS AND EQUIPMENT

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

3. EVAPORATOR TROUBLESHOOTING PROCEDURES

CAUTION: Do not operate air-conditioning system with condenser air inlet or outlet blocked.

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

A. Water is Being Blown from Air Outlets

1. Turn air conditioning system to ON.
2. Check evaporator drain for condensate runoff.
3. If no runoff, clear drain of blockage or verify that routing is in a down hill orientation.
4. Check the evaporator coil for bent fins. Straighten with a fin comb if necessary.
5. Select air conditioning OFF.

B. No Cooling at Evaporator

1. Connect service pressure gauges to service ports.

2. Turn air conditioning system to ON.

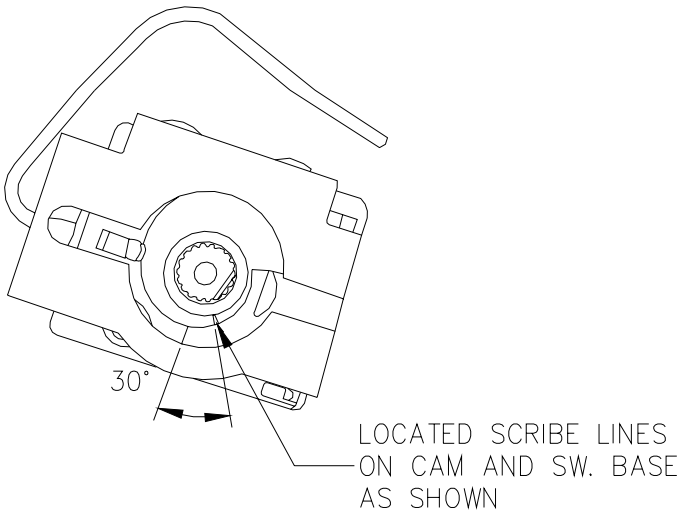
3. Check evaporator for proper cooling. If cooling is not sufficient, check refrigerant level to ensure that system is correctly charged. This can be confirmed by a clear sight glass (no bubbles) on the top of the receiver/drier bottle. If bubbles are present, recover and recharge per Section 1 System Servicing.

4. Check expansion valve bulb connection and proper orientation.

5. If system is correctly charged, replace expansion valve per Section 2 Maintenance Practices.

C. Evaporator Coil Freezes up

1. Checks freeze switch setting and adjust if necessary. If freeze switch setting are correct then replace freeze switch.



Freeze Switch Setting

4. BLOWER TROUBLESHOOTING PROCEDURES

REFERENCE THE BASIC AIRCRAFT WIRING DIAGRAM FOR SYSTEM SCHEMATIC.

A. Blower Inoperative

1. Check circuit breaker is in.

2. Remove connector at blower and check for presence of 28 VDC power at Pin B, and variable voltage Pin A in conjunction with speed control knob movement. Check for continuity to ground on Pin D.

3. If connector power and ground are present, then replace blower.

B. Blower Operational but No Speed Control

1. Remove connector and check Pin A for variable voltage in conjunction with speed control knob movement. If variable voltage is present replace Blower.

2. If variable voltage is not present, replace speed control potentiometer.

EVAPORATOR & BLOWER

MAINTENANCE PRACTICES

1. GENERAL

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

2. TOOLS AND EQUIPMENT

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

3. EVAPORATOR MAINTENANCE PROCEDURES

A. Evaporator Removal and Installation

1. Refer to aircraft maintenance manual.

B. Expansion Valve Replacement

1. Discharge system per Section 1 System Servicing.

2. Remove the thermal sensing element from its clamp located on the suction tube of the evaporator and carefully remove insulation covering sensing element.

3. Disconnect the fitting that connects the valve to the coil and cap the coil fitting.

4. Install new expansion valve and o-ring in the reverse order.

5. Lubricate o-ring with polyolester oil prior to assembly (do not apply sealant to threads). Torque fitting to 15-20 ft-lbs (20-27 N-m).

6. Install the thermal sensing element such that it makes contact with the suction tube along its entire length, and locate it at the 3 or 9 O'clock position on the tube. Insulate the sensing element thoroughly with insulation. *Note: an improperly insulated sensing element will affect the cooling performance.*

7. Charge system per Section 1 System Servicing.

C. Evaporator Coil Cleaning Procedure

1. Discharge system per Section 1 System Servicing.

2. Remove evaporator from aircraft and cap all fittings.

3. Use vacuum cleaner to remove large debris from the coil face.

4. Spray coil cleaner on coil face. Wash off with water ensuring no water enters the fittings.

5. Allow coil to thoroughly dry then reinstall evaporator and charge system per Section 1 System Servicing.

4. BLOWER MAINTENANCE PROCEDURES

A. Blower Removal and Installation

1. Refer to aircraft maintenance manual.

CONDENSER

DESCRIPTION AND OPERATION

1. GENERAL

The condenser assembly is located on the transmission's right hand side in-line with the oil cooler and includes a condenser coil and receiver/drier bottle mounting location.

This section of the maintenance manual discusses maintenance practices used for the condenser assembly portion of the air conditioning system. Refer to the Section 5 for the receiver/drier bottle.

CONDENSER

MAINTENANCE PRACTICES

1. GENERAL

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

2. TOOLS AND EQUIPMENT

Designation	Ref. No.	Qty	Remarks
Vacuum Cleaner	Comm. Avail.	1	None
Coil Cleaner	Comm. Avail.	A/R	Non-acid based
Fin Tool	Comm. Avail.	1	None

3. CONDENSER MAINTENANCE PROCEDURES

A. Condenser Removal and Installation

1. Refer to aircraft maintenance manual.

B. Condenser Coil Cleaning Procedure

1. Use vacuum cleaner to remove large debris from the coil faces.

2. Spray coil cleaner on coil faces. Wash off with water ensuring no water enters the fittings.

3. Allow coil to thoroughly dry.

COMPRESSOR

DESCRIPTION & OPERATION

1. GENERAL

The compressor assembly is mounted on the cooling fan shroud on the right hand side and includes the compressor and a pressure switch. The compressor compresses the refrigerant gas for condensing at ambient temperatures and pumps the refrigerant through the system. The compressor clutch is powered by 28 VDC.

This section of the maintenance manual discusses maintenance practices used for the compressor assembly portion of the air-conditioning system.

COMPRESSOR

MAINTENANCE PRACTICES

1. GENERAL

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

2. TOOLS AND EQUIPMENT

Designation	Ref. No.	Qty	Remarks
Sealant	ES49000-1	A/R	None
Polyolester Oil	Comm. Avail.	A/R	Viscosity ISO 68

3. COMPRESSOR MAINTENANCE PROCEDURES

A. Compressor Removal and Installation

1. Refer to aircraft maintenance manual.

B. Compressor Drive Belt Removal, Installation and Tensioning

1. Refer to aircraft maintenance manual.

C. Pressure Switch Replacement

1. Discharge system per Section 1 System Servicing.
2. Remove the compressor from the aircraft.
3. Disconnect the fitting that connects the pressure switch to the compressor and cap the compressor fittings.
4. Install new pressure switch and o-ring in the reverse order.
5. Lubricate o-ring with polyolester oil prior to assembly (do not apply sealant to the threads). Torque fitting to 15-20 ft-lbs (20-27 N-m).
6. Connect the red/white wire from the pressure switch to the compressor clutch coil wire. Cover with tubing and secure with tie wraps.

7. Reinstall compressor and charge system per Section 1 System Servicing.

D. Compressor Oil Check Procedure

To be accomplished only when a system component is replace or an oil level problem is suspected.

1. Operate air-conditioning system for 10 minutes to collect as much oil as possible in the compressor.

2. Discharge system per Section 1 System Servicing.

3. Remove compressor from aircraft and cap all fittings.

4. Remove oil fill plug and drain oil from compressor. Rotate clutch several times to drain all the oil.

5. Add six (6) fluid ounces of new polyolester viscosity grade ISO 68 oil to compressor oil fill port.

6. Clean oil fill port area and install oil fill plug. Torque plug to 6-9 ft-lbs (8.43-12.2 N-m).

7. Reinstall compressor and charge system per Section 1 System Servicing.

PLUMBING

DESCRIPTION & OPERATION

1. GENERAL

The plumbing system consists of flexible nylon lined refrigerant hoses with permanent swaged on fittings. All connections are tube o-ring type with sealant on the fitting mating surfaces to ensure leak free operation. The hose, o-ring material, and sealant are specially designed to work with refrigerant R134a and polyolester oil. The two service valves are sized differently to avoid incorrect cross connecting when gaining access to the plumbing for system servicing. A receiver/drier is installed downstream of the condenser on the condenser assembly to remove moisture from the liquid refrigerant. A binary pressure switch monitors the refrigerant gas pressure. This switch will open at a condenser over pressure of 384.0 $\pm$ 28.4 PSIG (2647.6 $\pm$ 195.8 KPa) and under pressured conditions of 30 PSI (206.8 KPa). This will interrupt the power to the compressor and stop the compressor.

This section of the maintenance manual discusses maintenance practices used for the plumbing portion of the air-conditioning system.

PLUMBING

MAINTENANCE PRACTICES

1. GENERAL

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

2. TOOLS AND EQUIPMENT

Designation	Ref. No.	Qty	Remarks
Sealant	ES49000-1	A/R	None
Polyolester Oil	Comm. Avail.	A/R	Viscosity ISO 68

3. PLUMBING MAINTENANCE PROCEDURES

A. Recommended Fitting Torque Specifications

Note: Torque values are for dry threads. It is recommended to torque to the low side value to prevent fitting twisting.

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

B. O-ring Replacement

1. Place appropriate sized o-ring over the tube “O” end of the fitting.

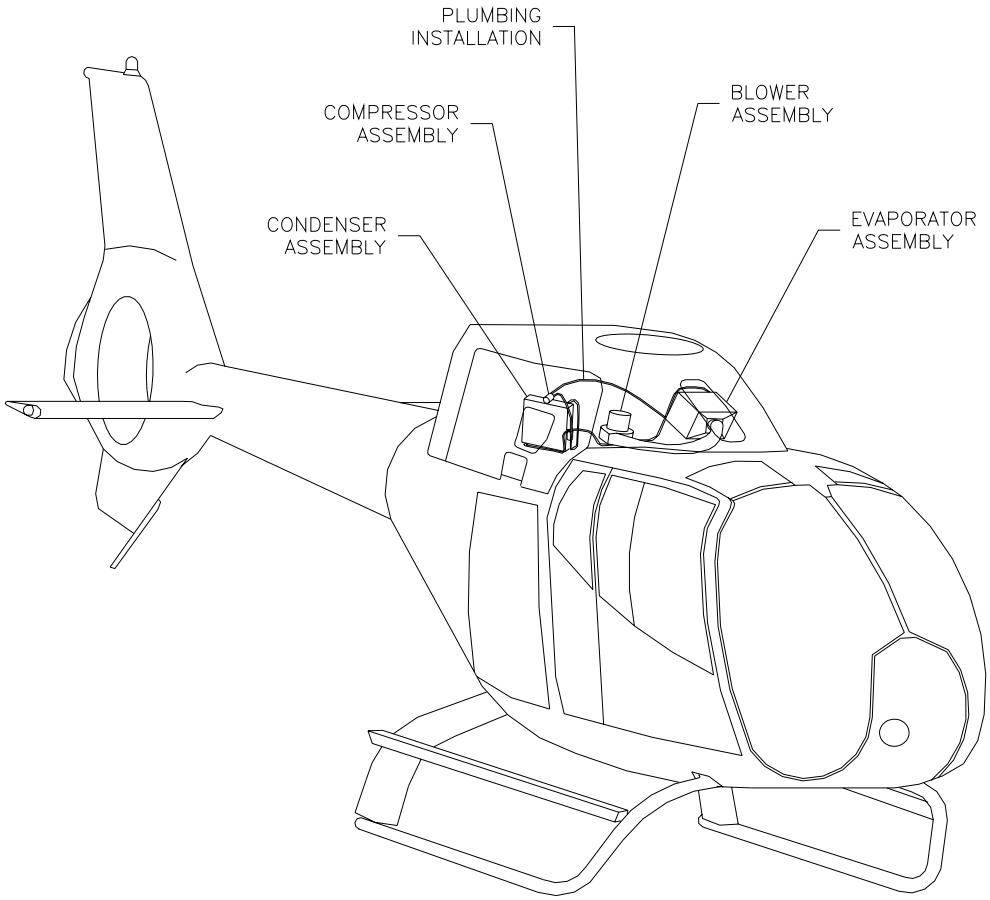
2. Lubricate o-ring with polyolester oil prior to assembly.

3. Apply sealant to all fitting mating surfaces prior to assembly. Do not apply sealant to the fitting threads.

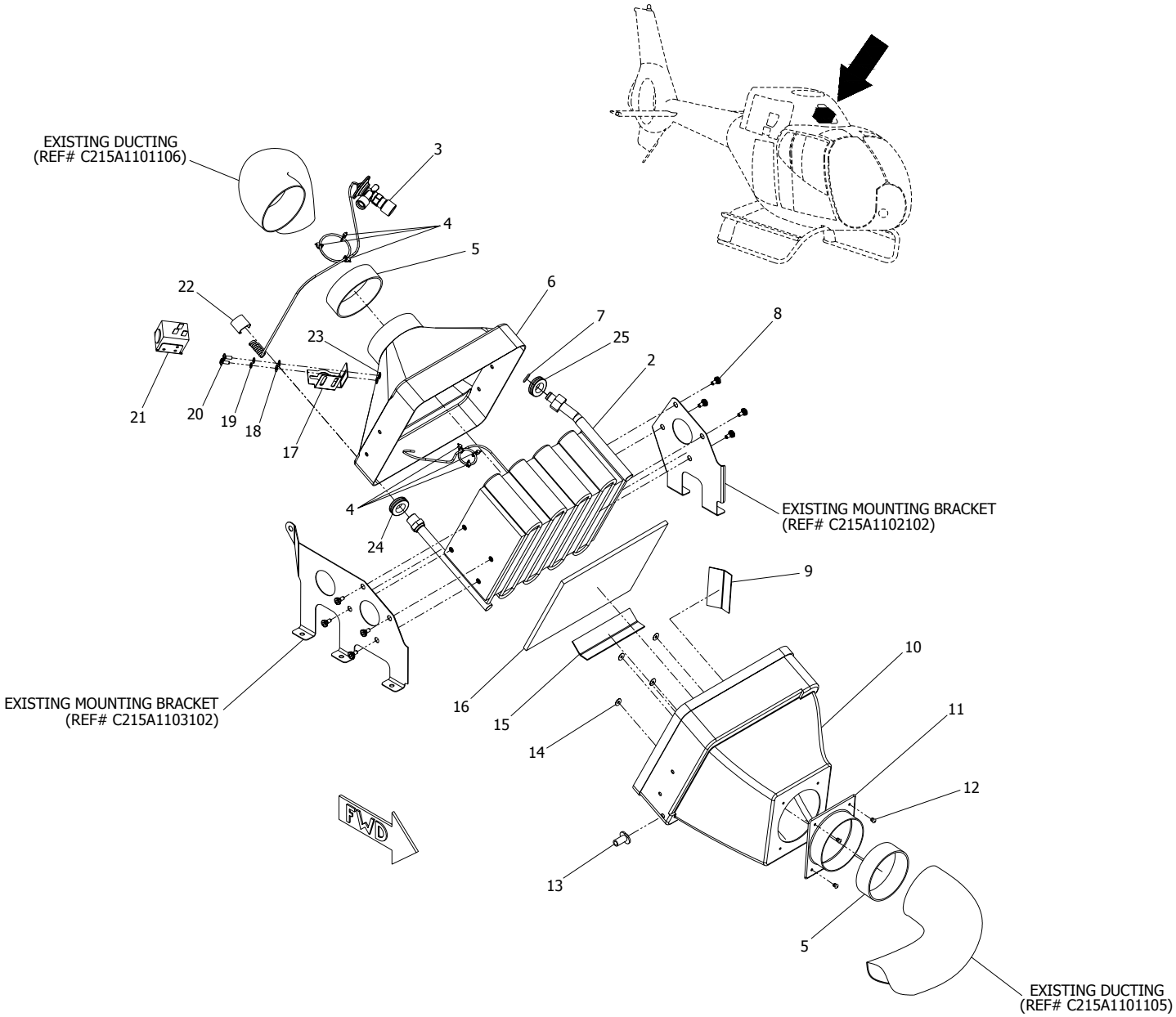
C. Receiver/Drier Replacement

NOTE: Replace the receiver/drier whenever the compressor is replaced or when the air-conditioning system plumbing is left open to the atmosphere for a time greater than 1 hour.

1. Discharge system per Section 1 System Servicing.
2. Remove the receiver/drier bottle from the aircraft and discard.
3. Install new receiver/drier bottle and o-rings in the reverse order.
4. Charge system per Section 1 System Servicing.

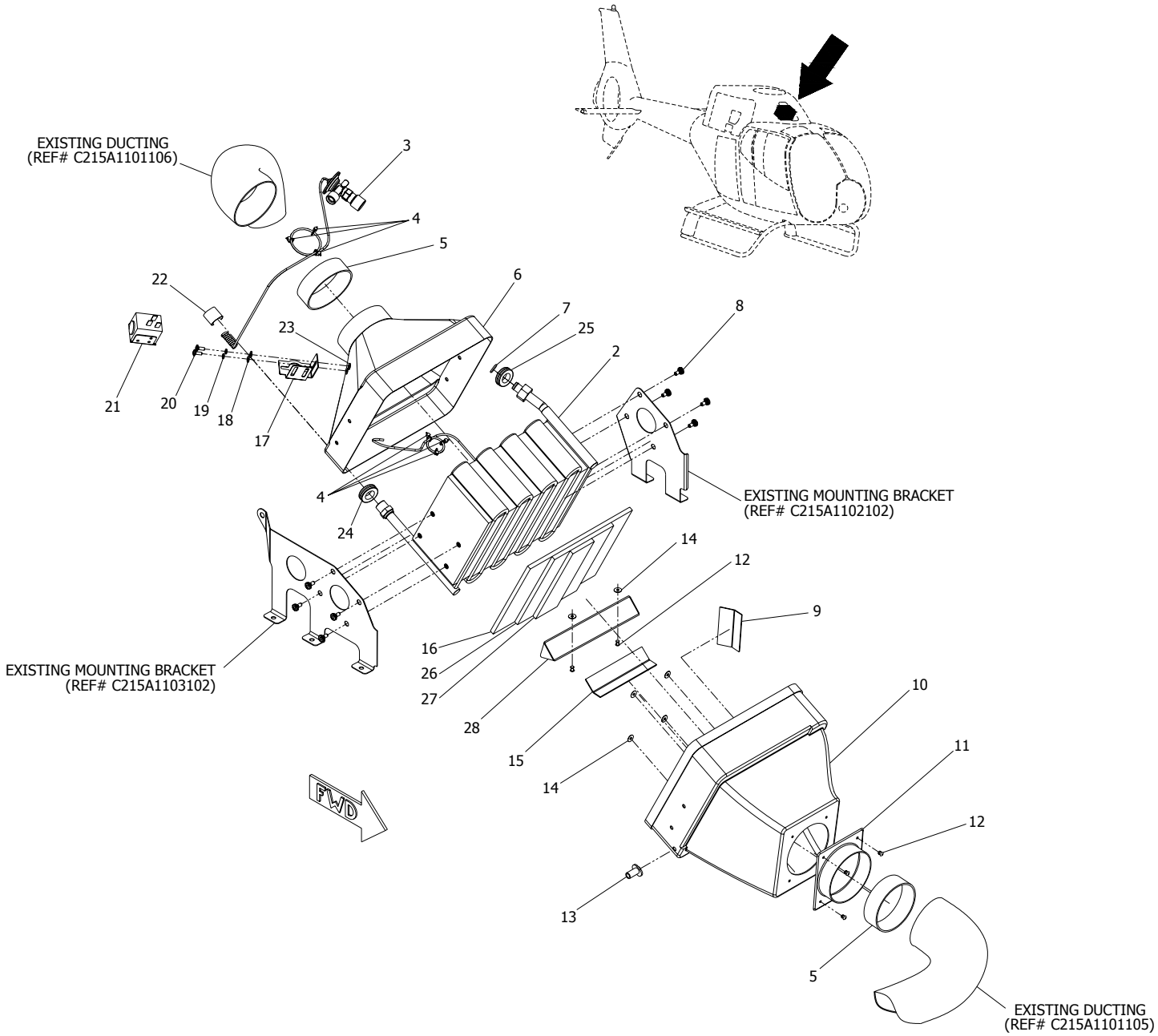


ILLUSTRATED PARTS CATALOG



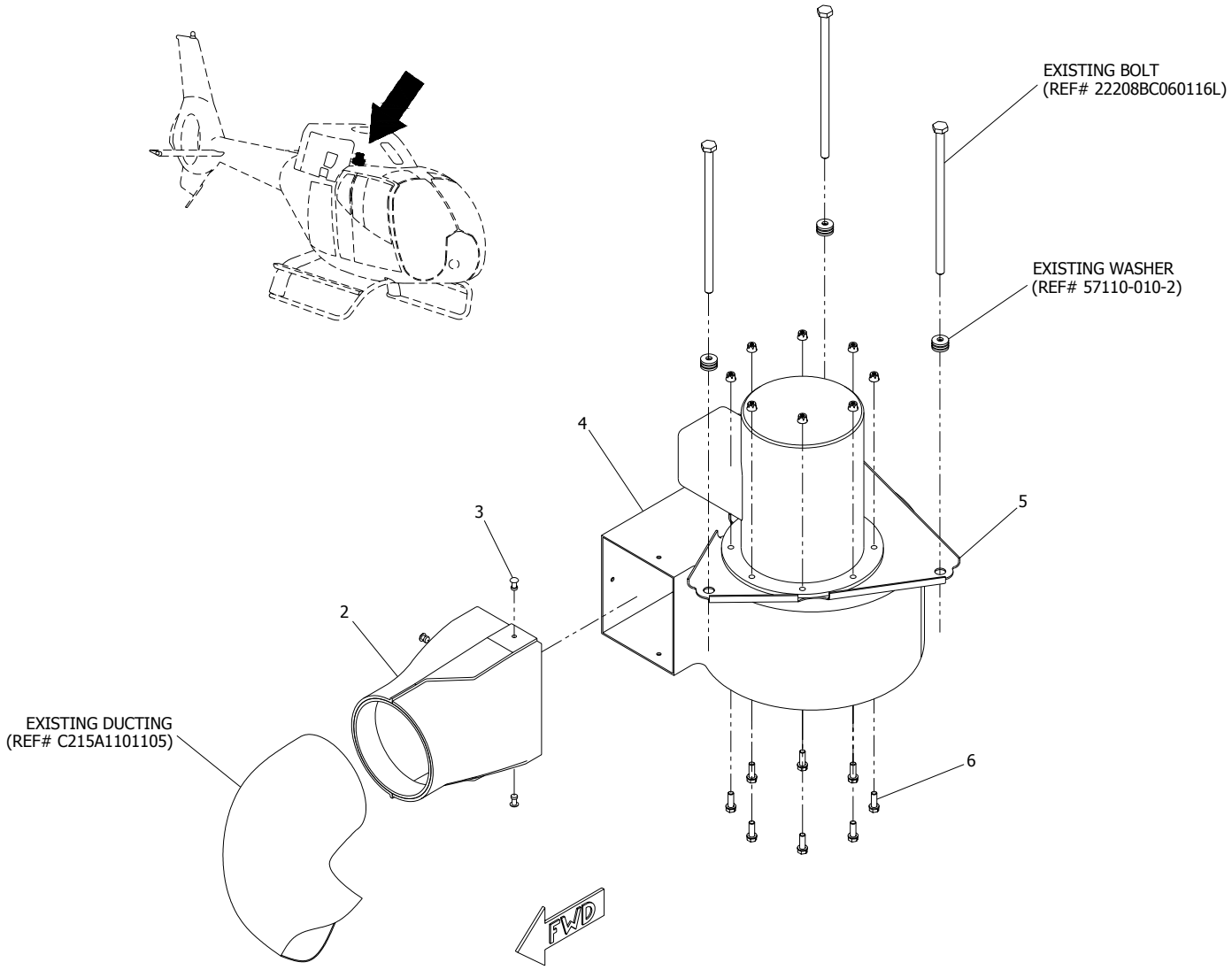
120-0250-1 Evaporator Assembly

ITEM	PART NUMBER	NOMENCLATURE	UNITS PER ASSEMBLY
1	120-0250-1	Evaporator Assembly	.
2	•120-0250-3	Coil Assembly	1
3	•ES26104-1	Expansion Valve	1
4	•ES30015-5	Cable Tie	6
5	•120-1250-5	Reinforcing Ring	2
6	•120-1250-2	Housing Outlet	1
7	•ES49011-2	O-Ring	1
8	• NAS6203-1H	Bolt	8
9	•120-1250-4	Side Air Deflector	1
10	•120-1250-1	Housing Inlet	1
11	•120-1250-9	Adapter	1
12	• ES31100-2	Rivet	4
13	• ES49006-1	Drain	1
14	• AN960-5L	Washer	4
15	•120-1250-3	Bottom Air Deflector	1
16	•120-1250-6	Screen	1
17	• JBS60-10	Bracket	1
18	• AN960-8L	Washer	2
19	• MS35338-42	Lock washer	2
20	• AN525-832R7	Screw	2
21	• JBS60-2	Thermostat	1
22	• ES26109-1	Sense Bulb Clip	1
23	• MS27130-A13	Rivnut	2
24	• MS35489-14	Grommet	1
25	• MS35489-17	Grommet	1



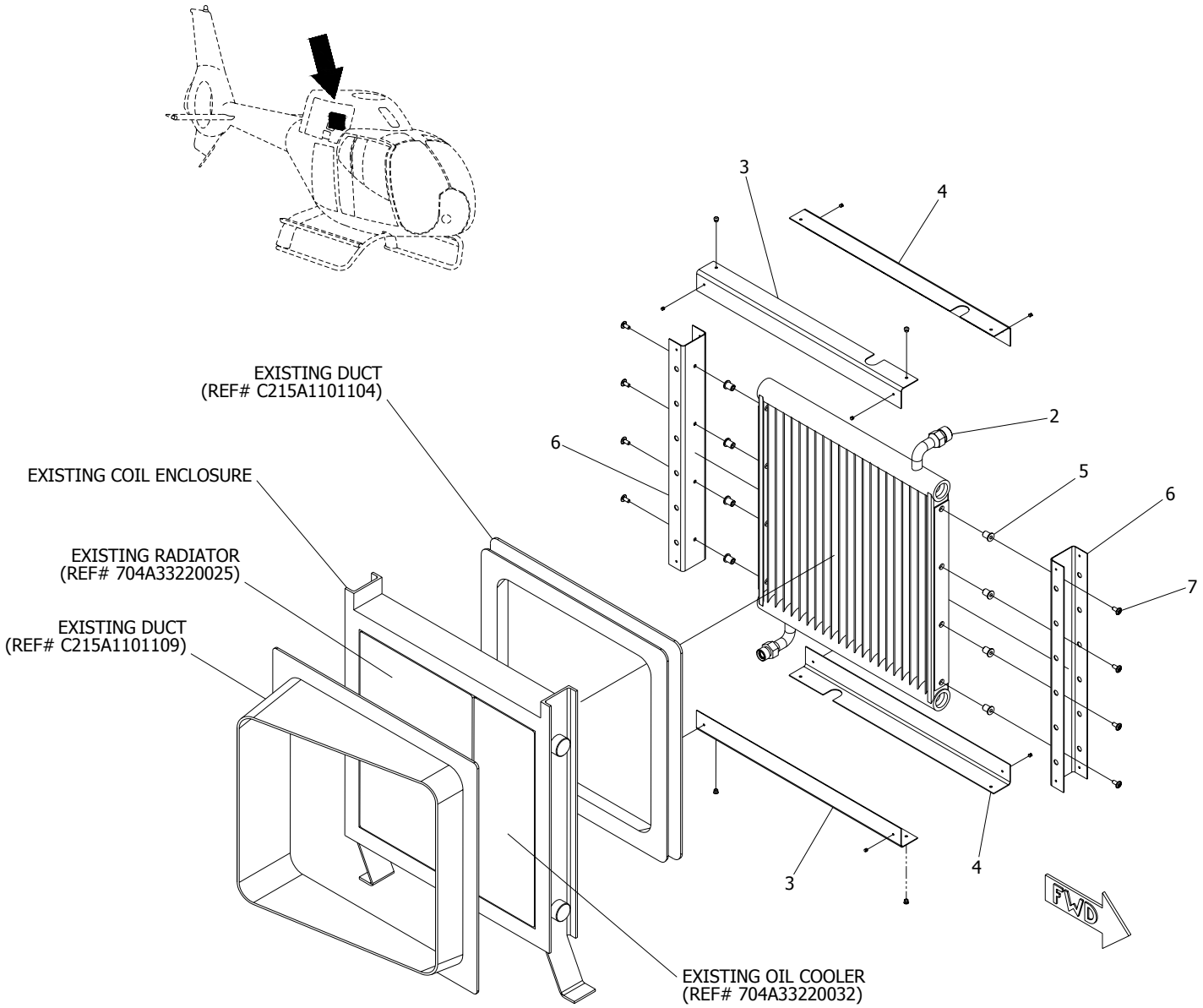
120-0252-1 Evaporator Assembly

ITEM	PART NUMBER	NOMENCLATURE	UNITS PER ASSEMBLY
1	120-0252-1	Evaporator Assembly	.
2	•120-0250-3	Coil Assembly	1
3	•ES26104-1	Expansion Valve	1
4	•ES30015-5	Cable Tie	6
5	•120-1250-5	Reinforcing Ring	2
6	•120-1250-2	Housing Outlet	1
7	•ES49011-2	O-Ring	1
8	• NAS6203-1H	Bolt	8
9	•120-1250-4	Side Air Deflector	1
10	•120-1250-1	Housing Inlet	1
11	•120-1250-9	Adapter	1
12	• ES31100-2	Rivet	6
13	• ES49006-1	Drain	1
14	• AN960-5L	Washer	6
15	•120-1250-3	Bottom Air Deflector	1
16	•120-1250-6	Screen	1
17	• JBS60-10	Bracket	1
18	• AN960-8L	Washer	2
19	• MS35338-42	Lock washer	2
20	• AN525-832R7	Screw	2
21	• JBS60-2	Thermostat	1
22	• ES26109-1	Sense Bulb Clip	1
23	• MS27130-A13	Rivnut	2
24	• MS35489-14	Grommet	1
25	• MS35489-17	Grommet	1
26	•120-1253-1	Screen	1
27	•120-1254-1	Screen	1
28	•120-1255-1	Air Deflector	1



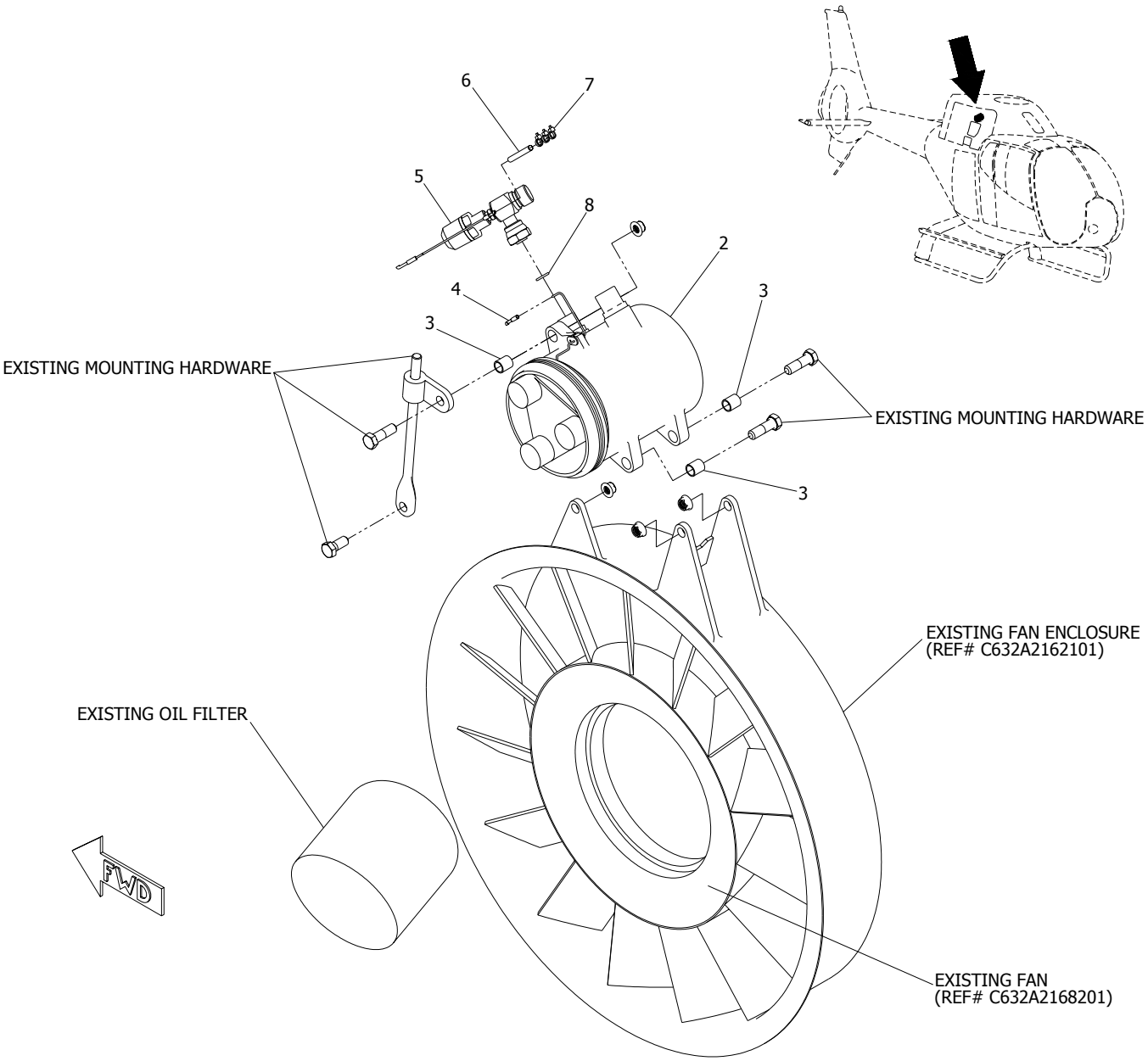
120-0260-1 Blower Assembly

ITEM	PART NUMBER	NOMENCLATURE	UNITS PER ASSEMBLY
1	120-0260-1	Blower Assembly	.
2	•120-0260-2	Adapter Assembly	1
3	•ES31100-2	Rivet	3
4	• ES73175-1	Blower	1
5	•120-1260-1	Bracket	1
6	• MS35206-245	Screw	8



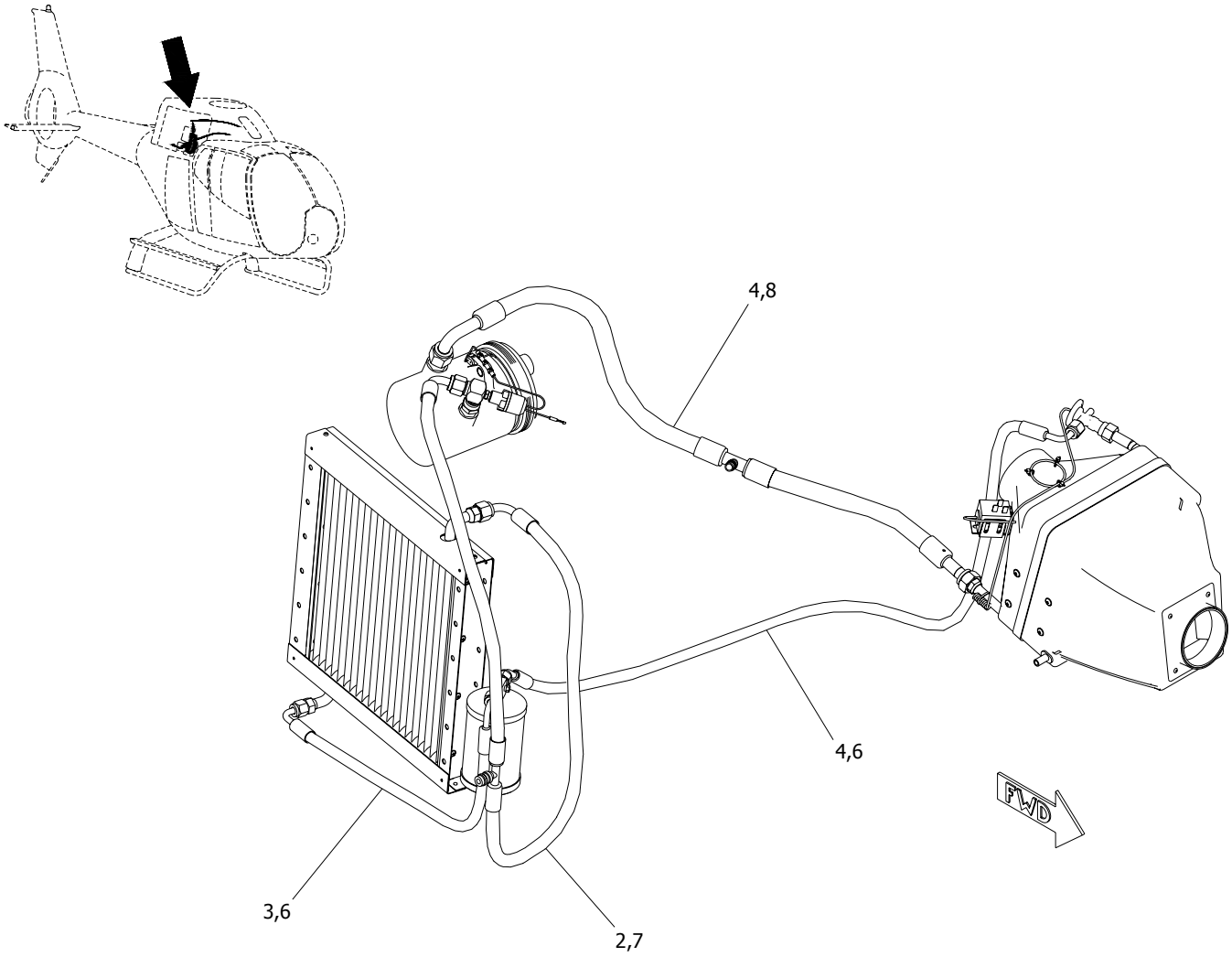
120-0350-1 Condenser Assembly

ITEM	PART NUMBER	NOMENCLATURE	UNITS PER ASSEMBLY
1	120-0350-1	Condenser Assembly	.
2	•JBS3173-2	Condenser Coil	1
3	•120-1350-2	Angle	2
4	•120-1350-3	Angle	2
5	•ES31068-1	Well Nut	8
6	•120-1350-1	Channel	2
7	•AN525-832R7	Screw	8



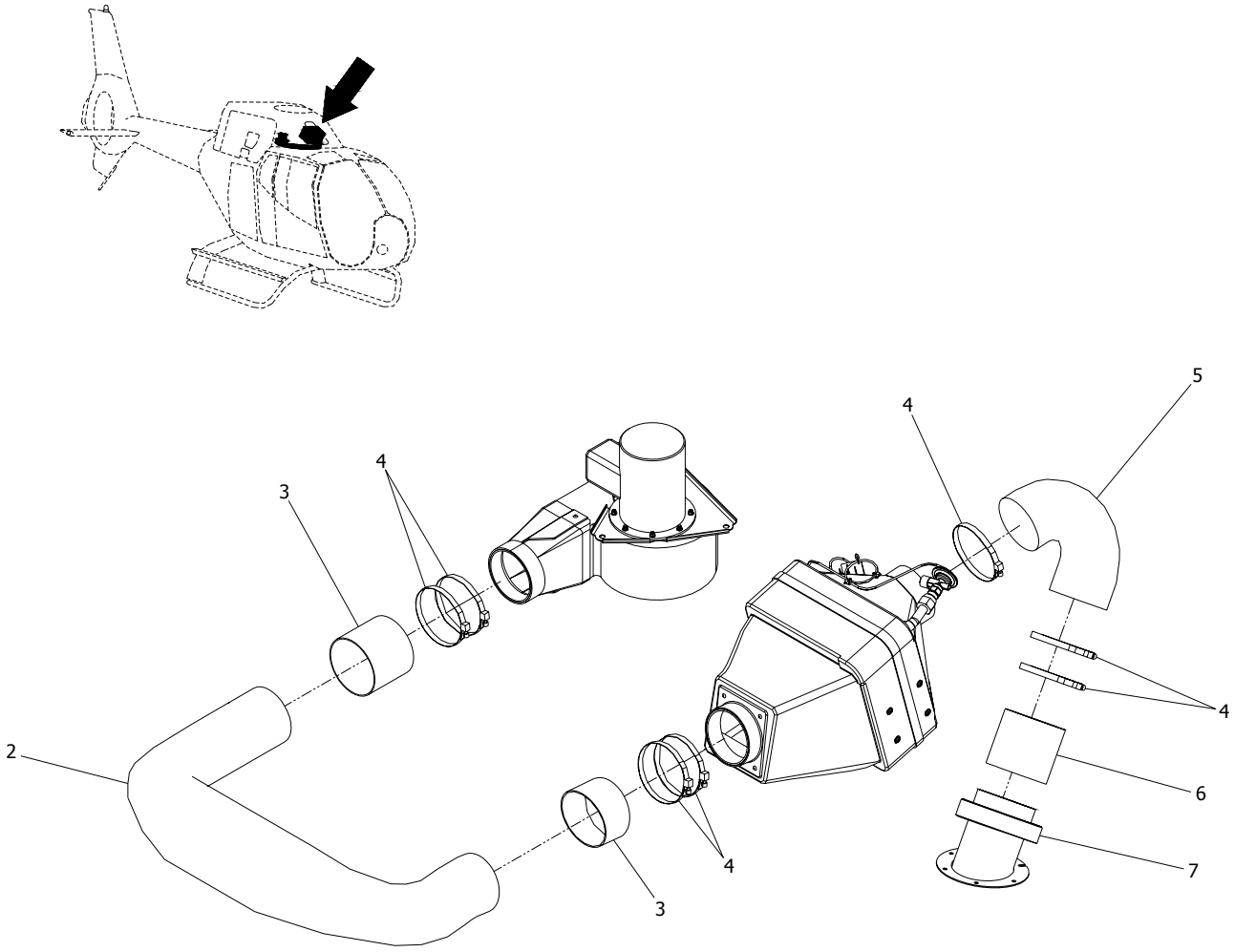
120-0450-1 Compressor Assembly

ITEM	PART NUMBER	NOMENCLATURE	UNITS PER ASSEMBLY
1	120-0450-1	Compressor Assembly	.
2	•ES10172-1	Compressor	1
3	•JBS456-12	Spacer	3
4	•ES55079-1	Splice	1
5	• JBS2020-11	Pressure Switch	1
6	• JBS570-10	Tubing	1
7	• ES30015-5	Tie Wrap	3
8	• ES49011-2	O-Ring	1



120-0850-1 Plumbing Set

ITEM	PART NUMBER	NOMENCLATURE	UNITS PER ASSEMBLY
1	120-0850-1	Plumbing Set	.
2	•120-0850-2	Hose Assy, Comp-Cond	1
3	•120-0850-3	Hose Assy, Cond-R/D	1
4	•120-0850-4	Hose Assy, R/D-Evap	1
5	•120-0850-5	Hose Assy, Evap-Comp	1
6	•ES49011-1	O-Ring	4
7	•ES49011-2	O-Ring	2
8	•ES49011-3	O-Ring	2



Ducting

ITEM	PART NUMBER	NOMENCLATURE	UNITS PER ASSEMBLY
1	.	Ducting	.
2	•C215A1101105	Conduit Under Cap	1
3	•706A34402163	Cuff	2
4	•ASNA0033-097	Clamp	7
5	•C215A1101106	Conduit Left Evaporator	1
6	•706A34402094	Cuff	1
7	• C215A1101801	Welded Assembly	1