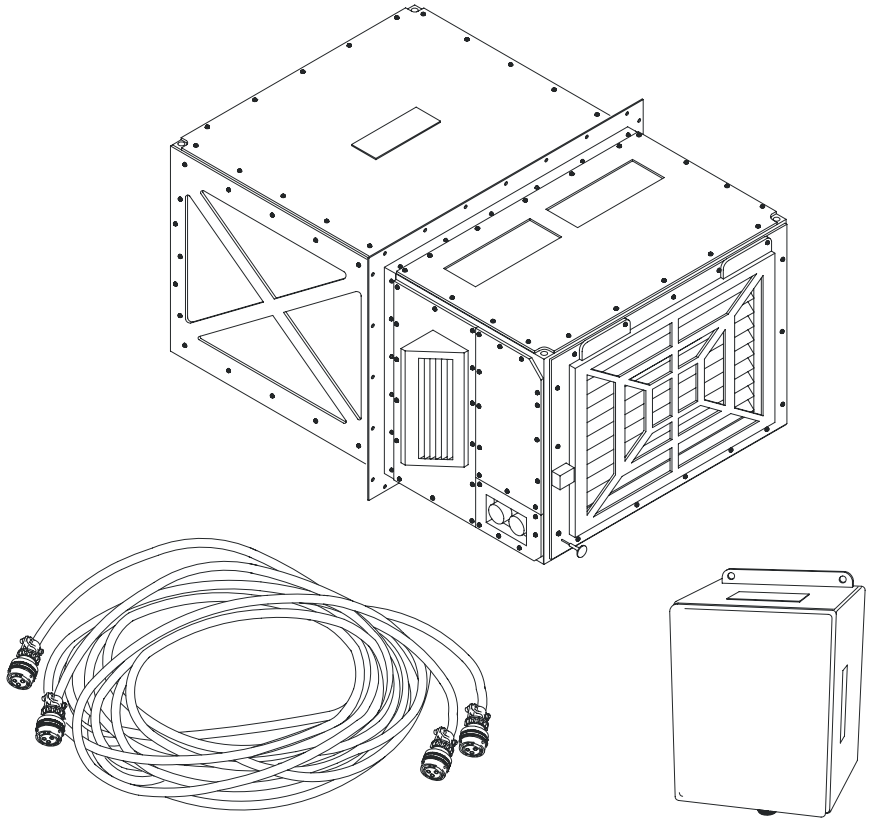
TM 9-4120-451-13&P

OPERATOR AND FIELD MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST FOR ENVIRONMENTAL CONTROL UNIT (ECU)



MODEL	NSN
ENVIRONMENTAL CONTROL UNIT	**4120-01-551-9191**

Nordic Air Incorporated
5455 Route 307 West
Geneva, OH 44041

HEADQUARTERS, DEPARTMENTS OF THE ARMY

DECEMBER 2007

WARNING SUMMARY

WARNING

This ECU operates on high voltage. DEATH or serious injury can result if proper safety procedures are not observed. Always disconnect the ECU from its power source prior to servicing.

WARNING

Fans and blowers are rotating parts that can cause severe injury. They may start without warning. Always disconnect the ECU from its power source prior to servicing. Do not operate the ECU with panels removed.

WARNING

Heating elements reach high temperatures. Severe burns are possible. Allow elements to cool before servicing.

WARNING

Refrigerant R-134a is used in this equipment. DEATH OR SERIOUS INJURY may result if personnel fail to observe safety precautions. Great care must be exercised to prevent liquid refrigerant, or refrigerant gas discharged under high pressure, to come in contact with any part of the body. Extremely low temperature resulting from rapid expansion of liquid refrigerant, or refrigerant gas discharged from under high pressure, can cause sudden and irreversible tissue damage through freezing. All personnel must wear thermal protective gloves and a face shield or goggles when working in any situation where refrigerant contact with skin or eyes is possible. Application of excessive heat to any component in a charged system will cause extreme pressure that may result in a rupture, possibly explosive in nature. Exposure of certain CFC (chlorofluorocarbon) and HCFC (halogenated chlorofluorocarbon) refrigerants to extreme heat or very hot surface will cause a chemical reaction in the gas to form carbonyl chloride (phosgene), a highly poisonous and corrosive gas. Generally, in their natural states, CFC and HCFC refrigerants are colorless, odorless vapors with no toxic characteristics, are heavier than air and will disperse rapidly in a well ventilated area. However, in an unventilated area, these refrigerants present a danger as an asphyxiate by displacing oxygen in the area.

WARNING

Connecting the ECU to a power source should only be done by qualified personnel.

WARNING

Make certain that the operation control switch is in the OFF position prior to turning the main circuit breaker ON

WARNING

Disconnect the ECU from the power source and remove the power connector from the ECU prior to performing any service or maintenance tasks.

WARNING

When using compressed air to clean filters or coils, limit pressure to 35 PSI.

Do not attempt to make any adjustments or repairs without proper tools.

WARNING

All repairs must be carried out in compliance with EPA Section No. 608 and applicable local air quality regulations.

WARNING

DEATH or serious injury may result if personnel fail to observe the following safety precautions

WARNING

When replacing a burned-out compressor, it is mandatory that the refrigeration system be thoroughly cleaned before operating the replacement compressor.

WARNING

Use rubber gloves and safety glasses and ventilate the workspace. The oil from a burnout could cause serious skin irritation and possibly burns. In some cases, the fumes are toxic.

WARNING

A refrigeration system should be evacuated whenever the system has been open in such a manner that there is a possibility that air and moisture could have entered the system. The evacuation process is intended to remove non-condensable gases and moisture from the portion of the system to be evacuated. The most important contaminant to be removed is moisture. To remove moisture from the system, it must first be boiled into vapor. Before water will boil at ordinary room temperature, for example, at 70°F the vacuum must be 29¼ inches of mercury at 30 inches of mercury barometric pressure. This means that the system must be within ¾ inches of mercury of absolute zero pressure. This low vacuum should be measured by using an absolute pressure gauge, such as an electronic gauge. For this reason, a good vacuum pump must be used to accomplish good dehydration.

WARNING

Use caution when heating copper tubing or working with a torch. Ensure area around copper tubing is clear or protected prior to heating. Failure to comply may result in serious injury to personnel or damage to equipment.

WARNING

Expansion valve is filled with mercury. In case of a leak, use extreme caution when handling. Failure to comply may result in serious injury to personnel.

WARNING

Compressor weighs approximately 125 lbs (57 kgs). Attach a suitable lifting device prior to removal. Failure to comply may result in serious injury to personnel or damage to equipment.

WARNING

Compressor weighs approximately 125 lbs (57 kgs). Attach a suitable lifting device prior to installation. Failure to comply may result in serious injury to personnel or damage to equipment.

WARNING

Use extreme caution when stepping, standing, and working on outside of van platform storage area. Failure to comply may result in serious injury to personnel.

WARNING

A/C unit weighs approximately 400 lbs (181 kgs). Attach lifting device to endless slings. Wear appropriate hard hats as required when working underneath lifting device and around A/C unit. Failure to comply may result in serious injury or death to personnel or damage to equipment.

WARNING

A/C unit weighs approximately 400 lbs (181 kgs). Attach lifting device to endless slings. Wear appropriate hard hats as required when working underneath lifting device and around A/C unit. Failure to comply may result in serious injury or death to personnel or damage to equipment.

WARNING

Bench test cable comes with one end that is bare wires for different applications. Attach these wires to the safest configuration available (i.e. circuit breaker panel, 208 3 Phase outlet, generator, etc). Ensure qualified personnel install wires per applicable safety standards. Failure to comply may result in serious injury or death to personnel or damage to equipment.

WARNING

Wear appropriate eye protection and gloves when working on air conditioner system. Failure to comply may result in injury to personnel.

Provide proper ventilation when working with refrigerants. Avoid breathing refrigerant vapors or lubricant mist. Failure to comply may result in injury to personnel.

WARNING

Use only approved storage tanks for refrigerants. Failure to comply may result in injury to personnel.

Do not use compressed air to test or pressure test a R134a system. Under certain conditions, pressurized mixtures of R134a and air can be combustible. In addition moisture can be injected into the system from shop air. Failure to comply may result in injury to personnel or damage to equipment.

WARNING

Troubleshooting must only be performed by qualified technicians. Serious injury or DEATH can occur.

WARNING

Many diagnostic tests require power to be present. Extreme care must be exercised to avoid injury or DEATH. High voltage is present in the electrical panel.

Remove rings, bracelets, watches, necklaces, and any other jewelry before working around vehicle. Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Failure to comply may result in injury to personnel.

Use care when working around ECU. High voltage is present. Failure to comply may result in injury to personnel.

WARNING

RISK OF INJURY. ALLOW ONLY QUALIFIED PERSONNEL TO OPERATE THE UNIT. Before operating the unit, the operator must be able to read and follow the instructions and warnings in this manual. The operator must be a certified technician and must be familiar with air conditioning and refrigeration systems, refrigerants, and the dangers of pressurized components.

PRESSURIZED TANK CONTAINS LIQUID REFRIGERANT. OVERFILLING THE TANK MAY CAUSEVIOLENT EXPLOSION AND POSSIBLE INJURY OR DEATH. Safety devices require the use of only authorized refillable refrigerant tanks. This includes Robinair Part Nos. 17506 and 34750 (50 lb.)tank. Do not recover refrigerants into a non-refillable storage container! Federal regulations require refrigerant to be transported only in containers meeting DOT spec. 4BW or DOT spec. 4BA.

ALL HOSES MAY CONTAIN LIQUID REFRIGERANT UNDER PRESSURE. Contact with refrigerant may cause injury. Wear correct protective equipment, including safety goggles. Use extreme caution when disconnecting hoses.

HIGH VOLTAGE ELECTRICITY INSIDE PANELS. RISK OF ELECTRICAL SHOCK. Disconnect power before servicing unit. Refer to the operating manual.

TO REDUCE THE RISK OF FIRE, avoid the use of an extension cord because an extension cord may overheat. However, if you must use an extension cord, the cord must be No. 14 AWG minimum, and keep the cord as short as possible. Do not use this equipment in the vicinity of spilled or open containers of gasoline, or other flammable substances.

Use this equipment in locations with mechanical ventilation that provides at least four air changes per hour, or locate the equipment at least 18 inches off the floor.

Verify all safety devices are functioning correctly before operating the unit. Before operating, read and follow the instructions and warnings in the operating manual.

Use this unit with R-12, R-134a, and ARI 98 Refrigerant Classes III and IV systems only. This unit is not designed for any other purpose than recovering or recycling refrigerants! Do not mix refrigerant types!

WARNING

CAUTION: To prevent personal injury,

- Wear safety goggles when working with refrigerant.
- Use only authorized refillable refrigerant tanks.
- Disconnect hoses using extreme caution!
- All hoses may contain refrigerant under pressure.
- Read and follow all warnings at the beginning of this manual before operating the unit.

WARNING

Wear safety goggles when working with refrigerant. Use only authorized refillable refrigerant tanks. Disconnect hoses using extreme caution!

All hoses may contain refrigerant under pressure. Read and follow all warnings at the beginning of this manual before operating the unit.

WARNING

Unplug the unit before beginning service work. Incorrect use or connections can cause electrical shock. Only qualified personnel should perform service work.

If scale assembly and UL circuit are not calibrated, scale can overfill the tank, causing possible explosion and/or vehicle overcharge.

TM 9-4120-451-13&P

INSERT LATEST UPDATED PAGES/WORK PACKAGES, DESTROY SUPERSEDED DATA

LIST OF EFFECTIVE PAGES/WORK PACKAGES

Note: The portion of text affected by the updates is indicated by a vertical line in the outer margins of the page. Updates to illustrations are indicated by miniature pointing hands. Updates to wiring diagrams are indicated by shaded areas.

Dates of issue for original and updated pages/work packages are:

Original 0 15 December 2007

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Vendor TOC i and ii	0
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Vendor Chapter 7	0
Supplemental Chapter 7	0
Chapter 8 to Chapter 10	0
Vendor Chapter 11	0
Chapter 12	0
Chapter 13	0

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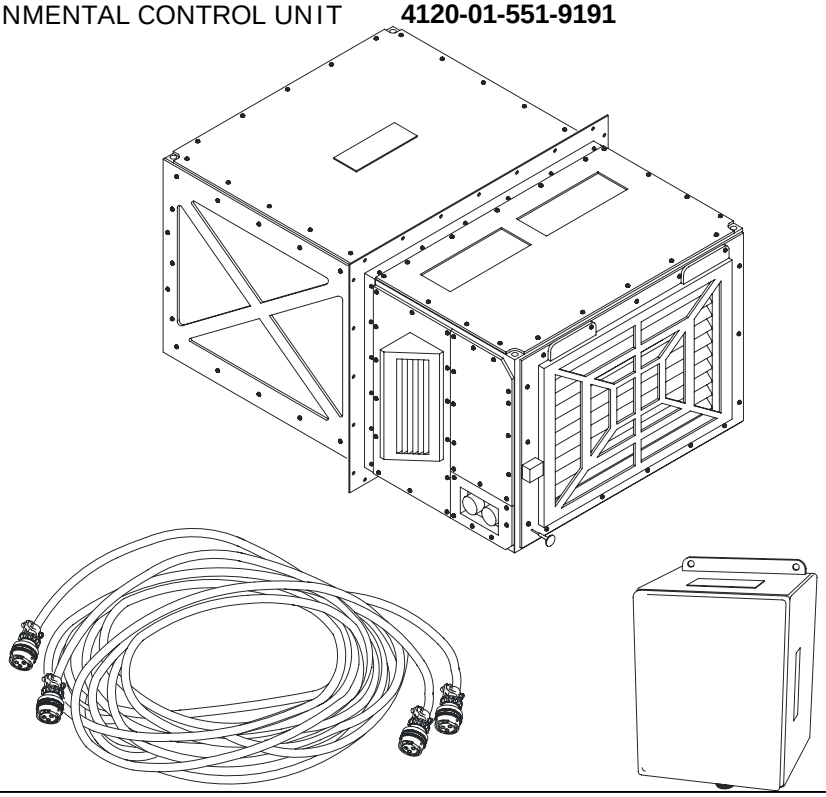
TM 9-4120-451-13&P

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 15 December 2007

OPERATOR AND FIELD MAINTENANCE INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST FOR ENVIRONMENTAL CONTROL UNIT (ECU)

MODEL	NSN
ENVIRONMENTAL CONTROL UNIT	**4120-01-551-9191**



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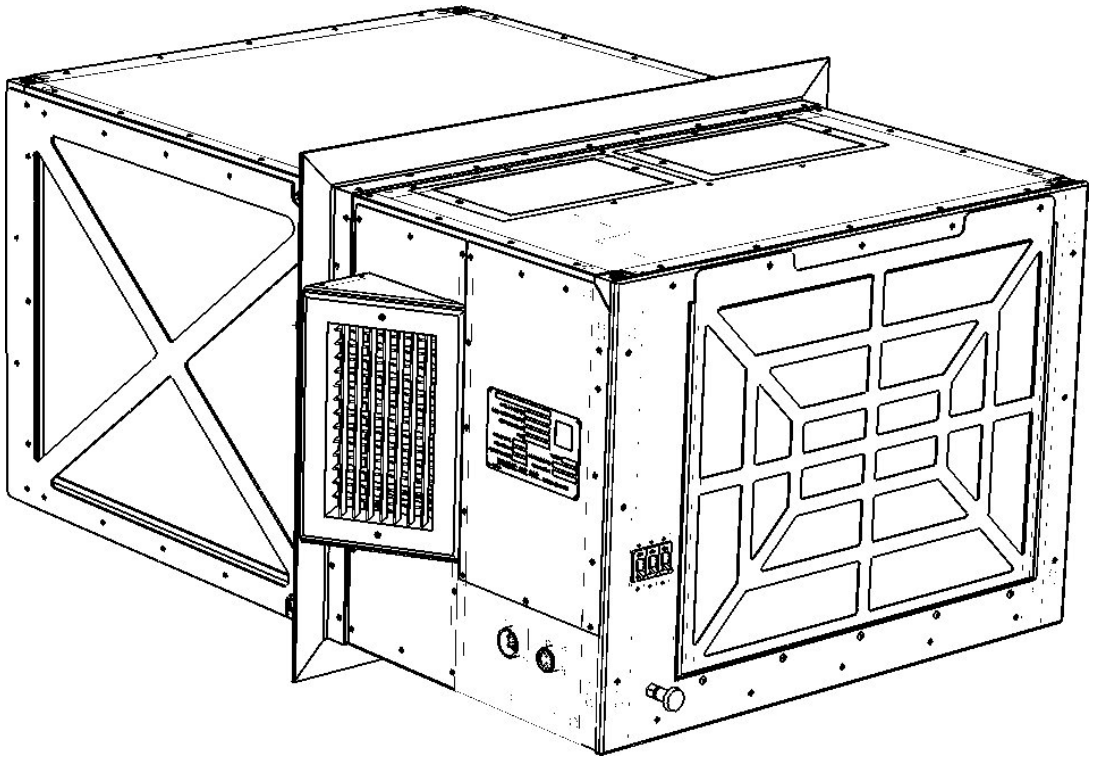
NORDIC AIR, INC.

ENVIRONMENTAL CONTROL UNIT (ECU)
48,000 BTUH (48 k) COOLING CAPACITY
20,000 BTUH HEATING CAPACITY

NORDIC AIR ECU MODEL NUMBER(S)	KS4853CAAFHMXG0/XGW - WHITE & GREEN KS4853CAAFHMXT0/XTW - WHITE & TAN
CAGE CODE	0WJE1
POWER	208-230 VAC, 3 phase, 50/60 Hz
REFRIGERANT	R-134a
REFRIGERANT CHARGE	10 LB 8 OZ (168 ounces)
WEIGHT	420 LBS



OPERATIONS AND MAINTENANCE MANUAL
566-00009-R2

NORDICAIR INCORPORATED

Table of Contents

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TABLE OF CONTENTS (SUPPLEMENTAL) - Continued

1 Introduction

1.1 Forward

This Operations and Maintenance Manual applies to an Environmental Control Unit (ECU) designed for field deployment. This ECU is designed to provide years of trouble-free service if installed, operated, and maintained in accordance with this manual. This manual provides user instruction for the safe operation of the ECU. This manual also provides maintenance, trouble shooting, and repair information to be used *by trained technicians*. Damage to the unit from improper installation, operation, or maintenance is not covered by the warranty.

1.2 Safety Summary

This ECU has been designed for safe and intuitive operation and maintenance. However, operators and service personnel must thoroughly read and understand the information presented in this manual. Improper use or servicing of this ECU can endanger personnel and damage the ECU.

Throughout this manual, statements of warning and caution are noted. Warning statements are prefaced by the term

WARNING!

Warning statements denote guidance that must be adhered to in order to avoid serious injury or DEATH.

Statements of caution are prefaced by the term

ATTENTION!

Caution statements denote guidance that must be adhered to in order to avoid damaging the equipment, improper operation, and possible voiding of the warranty.

1.3 Warnings

The following warnings apply to all operating and service tasks that may be performed on this ECU. All personnel who use or service this equipment must fully understand and act in accordance with these warnings.

WARNING!
This ECU operates on high voltage. DEATH or serious injury can result if proper safety procedures are not observed. Always disconnect the ECU from its power source prior to servicing.

WARNING!
Fans and blowers are rotating parts that can cause severe injury. They may start without warning. Always disconnect the ECU from its power source prior to servicing. Do not operate the ECU with panels removed.

WARNING!
Heating elements reach high temperatures. Severe burns are possible. Allow elements to cool before servicing.

WARNING!
Refrigerant R-134a is used in this equipment. DEATH OR SERIOUS INJURY may result if personnel fail to observe safety precautions. Great care must be exercised to prevent liquid refrigerant, or refrigerant gas discharged under high pressure, to come in contact with any part of the body. Extremely low temperature resulting from rapid expansion of liquid refrigerant, or refrigerant gas discharged from under high pressure, can cause sudden and irreversible tissue damage through freezing. All personnel must wear thermal protective gloves and a face shield or goggles when working in any situation where refrigerant contact with skin or eyes is possible. Application of excessive heat to any component in a charged system will cause extreme pressure that may result in a rupture, possibly explosive in nature. Exposure of certain CFC (chlorofluorocarbon) and HCFC (halogenated chlorofluorocarbon) refrigerants to extreme heat or very hot surface will cause a chemical reaction in the gas to form carbonyl chloride (phosgene), a highly poisonous and corrosive gas. Generally, in their natural states, CFC and HCFC refrigerants are colorless, odorless vapors with no toxic characteristics, are heavier than air and will disperse rapidly in a well ventilated area. However, in an unventilated area, these refrigerants present a danger as an asphyxiate by displacing oxygen in the area.

2 General Information

2.1 Equipment Descriptions

The ECU is a packaged system designed to operate in a portable field use application, providing conditioned air to a shelter. The ECU is controlled with a remote controller. The ECU operates using 208-230VAC 3-phase 50/60Hz power supplied by a generator or shore power via an auxiliary power plug located on the ECU. The refrigeration system uses R-134a refrigerant and has a cooling capacity at 60 Hz of not less than 48,000 BTU/Hr at 95° F ambient outside temperatures. The heating system is furnished with a 20,000 BTU/Hr resistive type heater in addition to the fan heat.

2.2 Design Features

2.2.1 Operational

Table 2.1

Capacity	48,000 BTU/Hr
Air Flow	600 CFM
Heating Capacity	20,000 BTU/Hr, 208 VAC
Design Maximum Ambient Temperature	125^0 F
Minimum Ambient Cooling	to 50^0 F
Minimum Ambient Heating	to -25^0 F

2.2.2 Physical Characteristics

Table 2.2

Height	26” OVER MOUNT FLANGE
Width	34” OVER MOUNT FLANGE
Depth	46”
Weight	420 Pounds

2.3 Special Features

SALT SPRAY PROTECTION - The cabinet is constructed of aluminum 5052-H32 alloy sheet; primed, and painted in accordance with the specification. All external hardware and all internal hardware is stainless steel, aluminum or has been protected against corrosion per the specification. The evaporator and the condenser coils are constructed from copper tubes and aluminum fins. The evaporator and condenser coils are coated with a protective coating. The motor shafts are made from stainless steel.

MAINTENANCE FEATURES

Sight Glass - A sight glass with a moisture indicator is provided to detect any moisture in the refrigeration circuit and low refrigerant levels. This feature is located on the side of the ECU

Service Valves - Suction and discharge Schrader service valves have been provided to enable servicing of the ECU. These features are located on the side of the ECU adjacent to the sight glass.

All major components are easily accessible for ease of maintenance.

SAFETY FEATURES

Low/High Pressure Switches - Low and high-pressure switches are provided. They are factory set for the application. The low pressure switch will disengage control power to the compressor contactor if suction pressure drops below a specific pressure. The high pressure switch will shut off the compressor if the discharge pressure rises above a specific pressure. These pressure switches are installed as safety devices and will help prevent compressor failure or other serious damage to the system components. If the ECU begins to cycle on high or low pressure, the unit should be removed from service and have the appropriate maintenance performed.

Pressure Relief Valve - The ECU is fitted with a relief valve that will discharge refrigerant should internal pressure exceed design parameters.

Overtemp Safety Switch - The ECU heater section is equipped with an overtemp safety switch. If the temperature in the heater cabinet exceeds the set point of the switch (130^0 F), power to the heater elements will be interrupted.

2.4 Major Components

Electrical Compartment - All of the major electrical control components are mounted in a control compartment on the side of the ECU that contains the secondary power connection. System controls are located adjacent to the control compartment. The controls and electrical components are access by removing the three sided top cover.

Evaporator Compartment - Contains the evaporator coil, expansion valve, blower, and some refrigeration components. Access to the compartment is gained by removing cover panels on the front, top or side of the unit.

Condenser compartment - Contains the condenser blower, compressor pressure switches and service features. Access to the compartment is gained by removing cover panel on the top of the unit.

Filter - The air conditioner contains a reusable return air filter. Access to the return air filter is thru the return air grille of the ECU.

2.4.1 Functional Components Description

Table 2.3

COMPONENT	FUNCTION
FILTER DRIER	Filters impurities and absorbs moisture from liquid refrigerant.
SIGHT GLASS	Provides means to monitor system charge and operation.
HIGH PRESSURE SWITCH	High Pressure set to break on excess pressure 425 psig. (Auto Reset)
LOW PRESSURE SWITCH	Shuts down the AC when refrigeration system pressures falls below 32 psig (Auto Reset)
CONDENSER FAN LOW AMBIENT PRESSURE SWITCH	Cycles the condenser motor to low speed to allow for low ambient temperature operation of the ECU.
SOLENOID VALVE	Cycle for temperature control through freeze stat.
HOT GAS BYPASS VALVE	Unloads compressor for temperature control
DESUPERHEATING THERMAL EXPANSION VALVE	Cools superheated liquid and returns to suction line for bypass mode operation.
HEATER SAFETY SYSTEM	High Limit Trip Switch set to break on electric heater compartment temperature rising above 130°F.
DISCHARGE PRESSURE SERVICE VALVE	For adding refrigerant charge and to diagnose system pressures.
SUCTION PRESSURE SERVICE VALVE	For adding refrigerant charge and to diagnose system pressures.
CONTROL PANEL	System Off-Fan-Auto, located on Remote Panel.
TIME DELAY RELAY (TD1)	Prevents compressor from short cycling
TIME DELAY RELAY (TD2)	Allows the ECU to start and pressurize in low ambient conditions.
TEMPERATURE CONTROL	Thermostat, Low ambient by-Pass, Heat, Cool.
THERMOSTATIC EXPANSION VALVE (TXV)	TXV set to maintain superheat of 10 – 15°F.
COMPRESSOR	Scroll type
CONDENSER & EVAPORATOR COILS	Copper tubing, aluminum fins, Electro-coated for corrosion protection

2.4.2 Identification

Table 2.4

NOMENCLATURE	NAI Model Number
ENVIRONMENTAL CONTROL UNIT, 48K BTU, 20K BTU HEAT	KS4853CAAFHMXG0/XGW - WHITE & GREEN KS4853CAAFHMXT0/XTW - WHITE & TAN

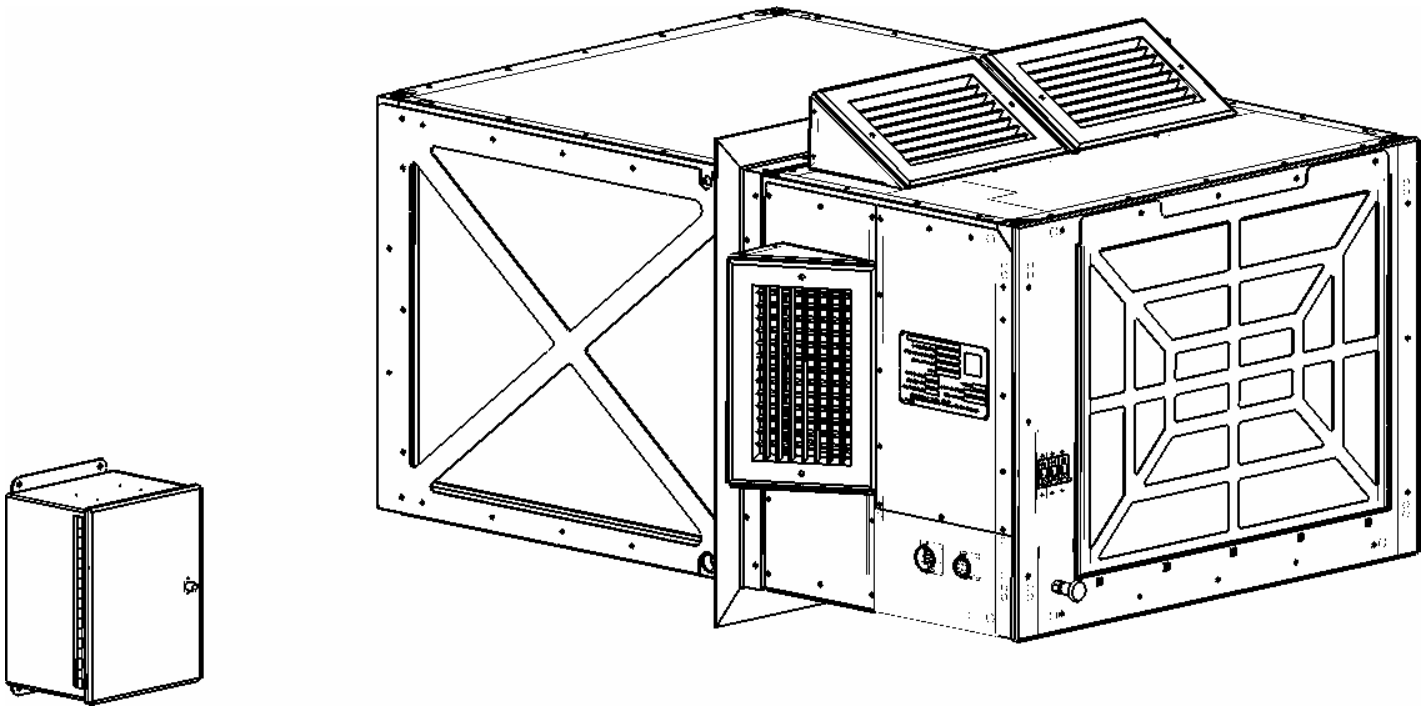


Figure 2.1

3 Functional Description

3.1 Introduction

This chapter describes the operation of the refrigeration and heating sub-systems.

3.2 Principles of Operation

The refrigeration system is a closed-loop circuit in which refrigerant is continuously circulated by the existing pressure differential created by the compressor. The compressor maintains high side condensing pressure, and the thermostatic expansion valve separates the high-pressure side from the low-pressure side at the evaporator coil inlet.

The compressor is designed to increase refrigerant pressure to a level high enough for it to be cooled and condensed into liquid by the ambient air being drawn over the condenser coil. The liquid refrigerant flows through the filter/drier, where moisture and other impurities are removed, then through the sight glass, a device for visual inspection of the refrigerant.

The liquid then flows through the thermostatic expansion valve, which meters the high-pressure liquid into the low-pressure refrigerant circuit. The thermostatic expansion valve is a pressure-reducing device metering high-pressure liquid refrigerant into the low-pressure evaporator coil in the amount required for the operating conditions. As the liquid enters the low pressure side of the circuit, it flows through the evaporator coil, boils by absorbing the latent heat of vaporization at the low pressure, and evaporates into a low pressure, low temperature gas. Heat from the surrounding air is extracted through the finned tubing of the evaporator coil by the refrigerant. The gas then returns to the compressor, where it is compressed and forced into the condenser coil, completing the cycle. The relationship of components involved in this process are illustrated in section 9.5 Refrigeration Schematic.

3.3 Operational Description

In Cool mode:

- Compressor, condenser fan and evaporator blower start.
- The Compressor takes low pressure, low temperature gas and compresses it to a high temperature, high-pressure gas.
- The refrigerant flows from the compressor to the condenser coil. The condenser fan draws outside ambient air in through the condenser coil. Heat is removed from the high temperature, high-pressure gas from the compressor by the flow of air over the condenser coil and is changed into a low temperature, high-pressure liquid.
- The refrigerant then flows through the liquid sight glass. This device indicates the presence of moisture and state of refrigerant in the system.

- The refrigerant filter/drier removes any moisture (water vapor) or impurities that may be carried by the liquid refrigerant.

- The expansion valve senses the temperature and pressure of the refrigerant as it leaves the evaporator coil. By use of a sensing bulb and an external equalizer line the valve constantly adjusts the flow of liquid refrigerant to the evaporator coil.

- As the liquid refrigerant leaves the expansion valve it passes through a distributor and capillary tubes and enters the evaporator coil. Warm air being drawn across the fins and tubes of the coil causes the refrigerant to boil and change to a gas (vapor). The evaporator fan draws the warm air from the conditioned space through the evaporator coil. As the air from the conditioned space comes in contact with the evaporator coil, the air is cooled.

- The refrigerant gas is then drawn back to the compressor and the cycle is repeated.

- There is also a bypass circuit that allows the system to continue to run even if the thermostat is satisfied. The evaporator bypass solenoid shuts off flow of refrigerant to the evaporator coil prior to entering the thermal expansion valve. The hot gas valve allows a portion of the high temperature, high-pressure gas to bypass from the discharge side of the compressor to the suction side of the compressor. The de-superheating valve takes low temperature, high-pressure liquid from the condenser coil and changes it into low temperature, low-pressure liquid and also returns it to the suction side of the compressor. This function allows the ECU to run continuously.

In Heat mode:

- The evaporator blower starts and the heating elements are energized.

- The evaporator blower circulates return air over the heating elements. Air warmed by the elements exits out the supply duct.

- Power to the elements will be interrupted if the over-temperature switch senses temperatures greater than 130°F.

In Fan mode:

- The evaporator blower starts.

- Air is circulated from the return duct, exiting the supply duct.

4 Installation

4.1 Unit Setup

The unit is to be installed through the side wall of a shelter with a minimum opening size of 22.5” high by 30.5” wide. The ECU should be supported from underneath on the outer side of the shelter. Four 1/4-20 threaded mounting holes are provided for securing the ECU.

The ECU should be set in a level location for best operation, and should not be on an incline of greater than 10° in any direction.

4.2 Cable Installation

Put the main circuit breaker, found on the front return panel, in the OFF position. Attach the power cable connector to the external power connector located on the side of the ECU. Ensure the connector is securely tightened. Connect the opposite end to a 208V 50 or 60 Hz power source according to the color coding set forth in the wiring diagram.

Attach the remote cable connector to the external control connector located on the side of the ECU. Locate the controller in a location that is not directly in the path of the supply or return air.

WARNING!
Connecting the ECU to a power source should only be done by qualified personnel.

4.3 Other Preparations

Ensure that the condensate drain, found on both sides of the ECU is unobstructed. A hose with a ½” M-NPT fitting may be attached to each drain coupling to route the water to a desired discharge location.

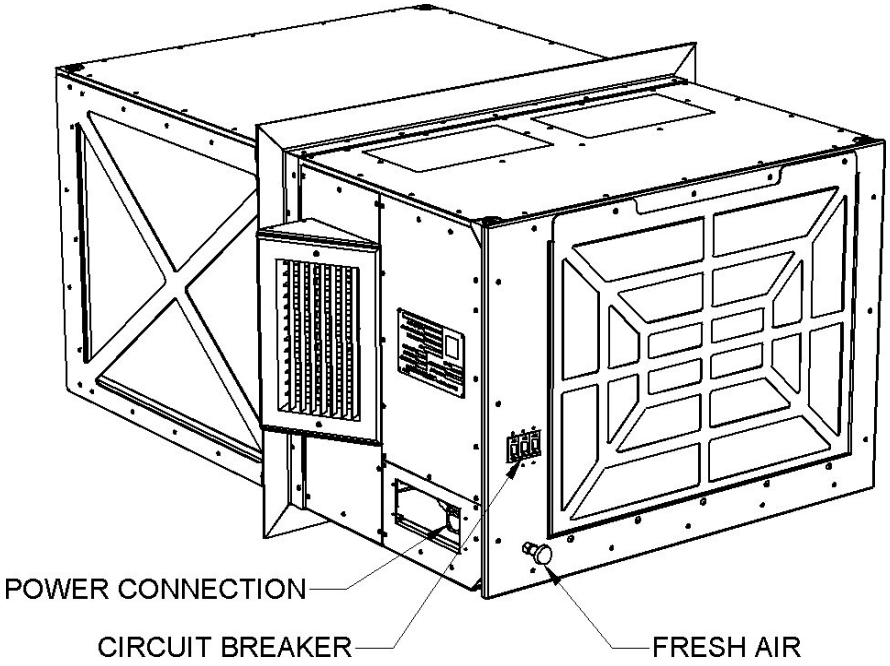


Figure 4.1

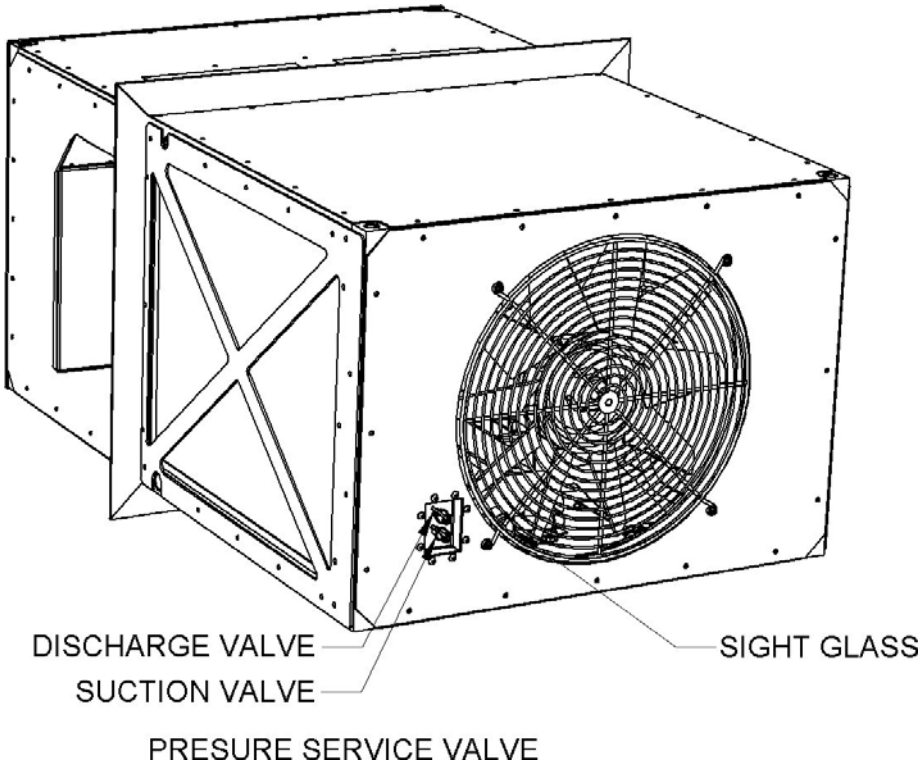


Figure 4.2

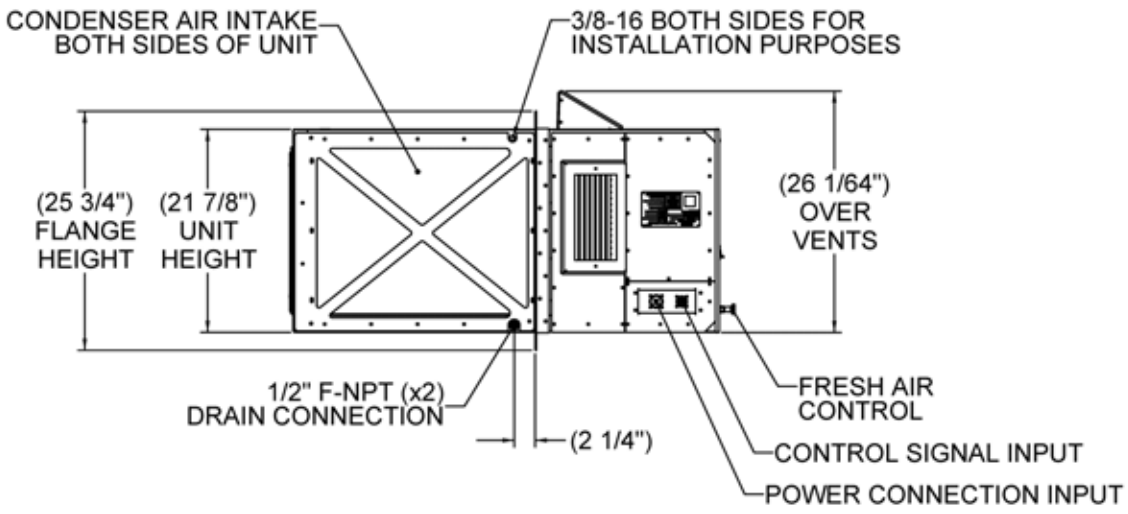


Figure 4.3 Condensate Drain Location

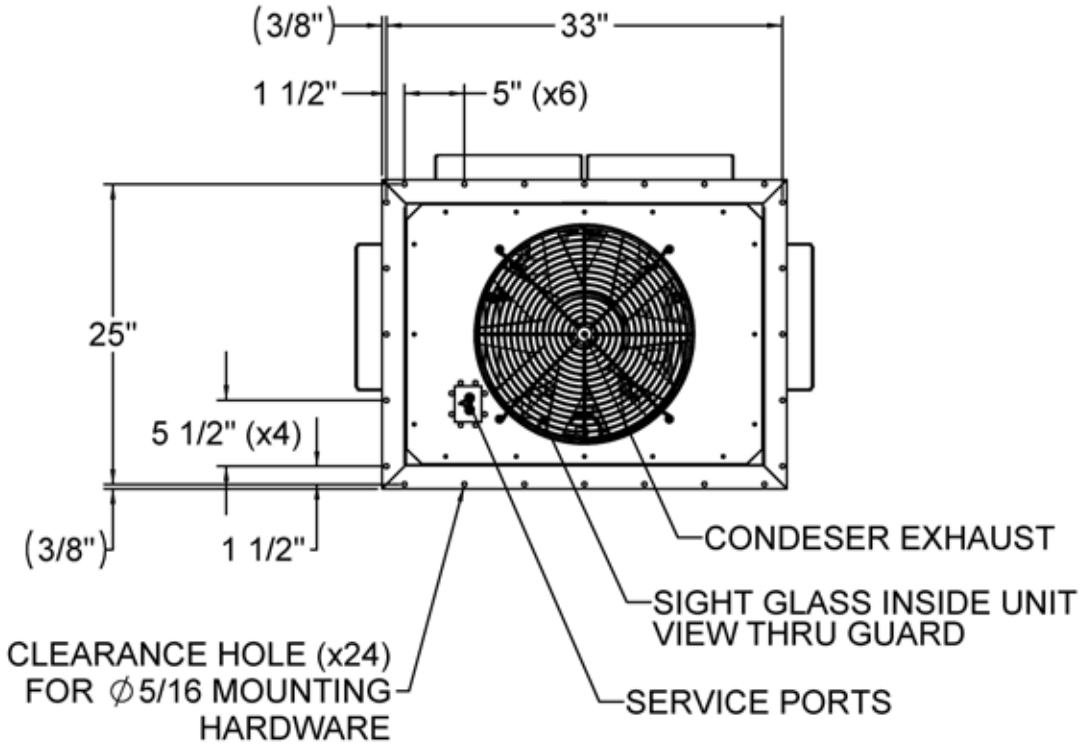


Figure 4.4 Flange Mounting Pattern

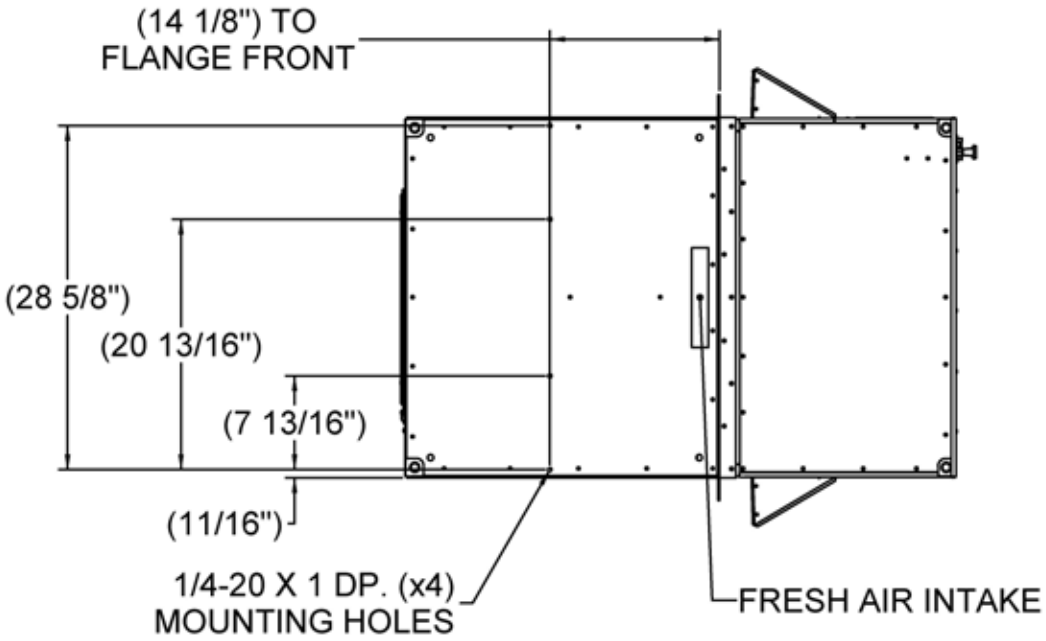


Figure 4.4 Bottom Mounting Pattern

5 Operators Instructions

This section will provide operational instruction for the KS4853CAAFHMX-- Environmental Control Unit. Review and understand these instructions before operating the unit.

5.1 Single Unit Control

Single unit control module consists of two selector switches, thermostat and indicator lights.

- **The ECU Controls** are remote mounted for this unit. Local ECU controls consist of a circuit breaker and fresh air control.
- **The Unit Selector Switch and Main Breaker** should always be in the **OFF** position when connecting or disconnecting power to the system.

WARNING!
Make certain that the operation control switch is in the OFF position prior to turning the main circuit breaker ON

- When proper operating voltage is applied to the unit and the main breaker switched to the **ON** position, the **RED** indicator will light momentarily while the voltage monitor acknowledges proper voltage and phasing.
- Once the monitor acknowledges proper voltage and phasing the **RED** indicator will go off and the **GREEN** indicator will light. The **GREEN** indicator will remain lit as long as proper voltage is applied.
- **Local/Remote Switch** - This switch allows transfer of ECU control from the local control panel located on the front of the ECU to the remote controller located in the shelter.
- If the **RED** light remains lit, there is a discrepancy with the supply voltage with regard to one or more of the following: a) Phase rotation, b) Voltage level and c) Low, missing or unbalanced legs.
- The selector knob is for selecting between “OFF”, “FAN” and “AUTO”.
    1. “FAN” operates only the evaporator fan for ventilation.
    2. “AUTO” operates the ECU in either heating or cooling according to the selected set point and the temperature of the room.
- This unit is supplied with a two stage thermostat and will control the heat and cool functions of the ECU.

5.2 Setting the Thermostat

5.2.1 Units

To switch between °F and °C press and release the **°F** key.

5.2.2 Set Point

- To set the temperature set point, press the **SET** key twice. Toggle the temperature either up or down by using the ⮝ or ⮟ keys to the desired temperature. When finished press the SET key once and the control will toggle back to display the room temperature.
- Factory Setting: 70°F
- Range: 60°F to 90°F

5.2.3 Temperature Differentials

5.2.3.1 Heat-AC ΔT

- Press and Hold the **°F** key for seven (7) seconds until the control displays ***deb***. Press the **°F** key once to access the ΔT setting. Use the ⮝ or ⮟ keys to set the differential.
- Factory setting: 2°F
- Range: 1 to 10°F

Heat ΔT

- Press and Hold the **°F** key for seven (7) seconds until the control displays ***deb***. Press the **°F** key until the control displays ***hdf***. Press the **°F** key once to access the ΔT setting. Use the ⮝ or ⮟ keys to set the differential.
- When finished, press **°F** key until room temperature is displayed.
- Factory setting: 2°F
- Range: 1 to 10°F

AC ΔT

- Press and Hold the **°F** key for seven (7) seconds until the control displays ***deb***. Press the **°F** key until the control displays ***adf***. Press the **°F** key once to access the ΔT setting. Use the ⮝ or ⮟ keys to set the differential.
- When finished, press **°F** key until room temperature is displayed.
- Factory setting: 2°F
- Range: 1 to 10°F

5.2.3.2 **Calibration Offset**

- Press and Hold the **°F** key for seven (7) seconds until the control displays ***deb***. Press the **°F** key until the control displays ***cal***. Press the **°F** key once to access the ΔT setting. Use the ⮝ or ⮟ keys to set the differential.
- When finished, press **°F** key until room temperature is displayed.
- Factory setting: 0°F
- Range: -30 to 30°F

An automatic timer prevents the compressor from re-starting for 2 minutes when the compressor stops for any reason to allow the system to equalize pressures.

In the **automatic** modes all operational functions will cease when the cooling or heating demand set on the thermostat is satisfied.

The toggle switch is for selecting between “HIGH” and “LOW” fan speed.

The **FRESH AIR** feature is activated by pulling the black knob on the front of the ECU. Fresh air is added to the indoor air when the evaporator fan is running.

Never operate the unit without a clean intake filter and all covers and guards in place.

Keep coils and air movers clean and unhindered.

5.3 REMOTE CONTROL

5.3.1 Hidden Button (Button Above SET) Function:

Step	Action	Output
1.	Power up unit. Wait for unit to display temperature.	Display “888” for 2 seconds then display current temperature.
2.	Press Hidden Button.	Display “dEb” for deadband.
3.	Press Hidden Button.	Display current deadband setting. Press UP or DOWN arrows to adjust value.
4.	Press Hidden Button.	Display “HdF” for heat differential.
5.	Press Hidden Button.	Display current heat differential. Press UP or DOWN arrows to adjust value.
6.	Press Hidden Button.	Display “AdF” for air conditioning differential.
7.	Press Hidden Button.	Display current air conditioning differential. Press UP or DOWN arrows to adjust value.
8.	Press Hidden Button.	Display “CAL” for temperature sensor calibration value.
9.	Press Hidden Button.	Display current temperature sensor calibration value. Press UP or DOWN arrows to adjust value.
10.	Press Hidden Button.	SAVES ALL CHANGED VALUES TO MEMORY. CONTROLLER WILL NOT SAVE VALUES IF MENU TIMES OUT (15 seconds).
11.	**End of Function**	

5.3.2 SET Button Function:

Step	Action	Output
1.	Power up unit. Wait for unit to display temperature.	Display “888” for 2 seconds then display current temperature.
2.	Press Set Button.	Display “SP1” for set-point 1.
3.	Press Set Button.	Display current set-point 1 setting. Press UP or DOWN arrows to adjust value.
4.	Press Hidden Button.	SAVES ALL CHANGED VALUES TO MEMORY. CONTROLLER WILL NOT SAVE VALUES IF MENU TIMES OUT (15 seconds).
5.	**End of Function**	

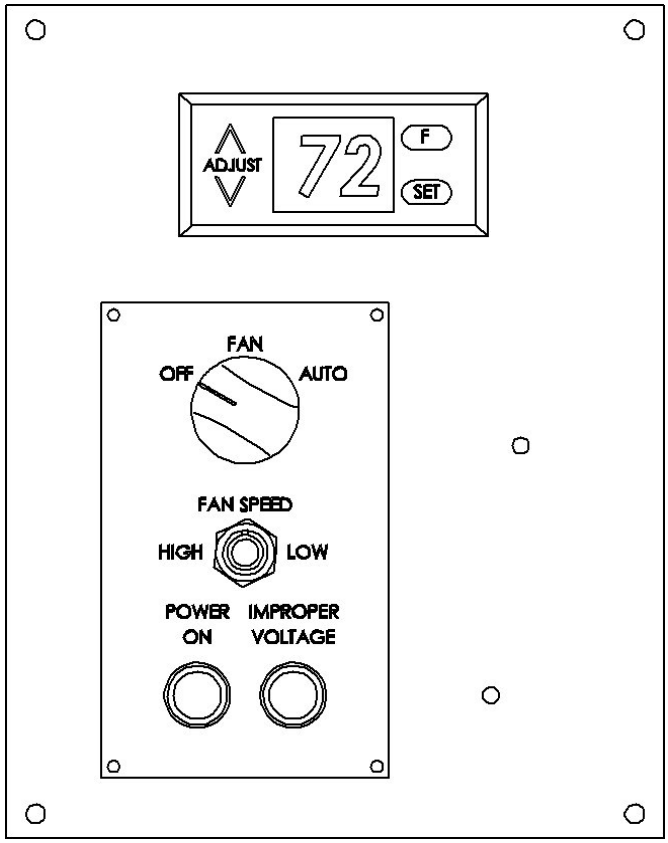


Figure 5.3
Remote Control

5.3.3 Control Features:

5.3.3.1 Membrane touch-pad programming

5.3.3.2 0.56" HIGH Red LED Display (Three Digits)

5.3.3.3 Panel Mount enclosure

5.3.3.4 Three relay outputs

5.3.3.5 Three digit °F / °C display select.

5.3.4 Control Functions:

5.3.4.1 Display

- Normally Display Room Temperature
- Set Point shall be displayed after either of the ⮝ or ⮟ switches is pressed.
- Set Point shall be a single temperature adjustable by using the ⮝ and ⮟ switches.
- Set Point will be adjusted when either of the switches is pressed (not when released).
- The Set Point shall remain displayed for 3 seconds after any adjustment before reverting back to Room Temperature display.
- Set Point Range = 60-90°F.
- Room Temperature Display Range capable of:
  = -9°F through 99°F
  = -9°C through 99°C
  = ¯ for temperatures above the range
  = _ for temperatures below the range.
- Increment = 1°F when displaying °F; = 1°C when displaying °C.
- Factory Setting = 70°F.

5.3.4.2 **Heat - A/C ΔT (Deadband)**

Heat - A/C ΔT shall be a tamper resistant, but adjustable value by using the ⮝ and ⮟ switches. This value will define the temperature difference between nominal Heat and nominal A/C control temperatures.

Range = 1-10°F
Increment = 1°F
Factory Setting = 2°F

5.3.4.3 **Heat ΔT (differential)**

Heat ΔT shall be a tamper resistant, but adjustable value by using the ⮝ and ⮟ switches. This value will define the temperature span between temperatures at which Heat will turn ON and Heat will turn OFF. This span shall be centered about nominal Heat.

Range = 1-10°F
Increment = 1°F
Factory Setting = 2°

A/C ΔT

A/C ΔT shall be a single value adjustable by using the ⮝ and ⮟ switches. This value will define the temperature span between temperatures at which A/C will turn ON and A/C will turn OFF. This span shall be centered about nominal A/C.

Range = 1-10°F
Increment = 1°F
Factory Setting = 2°F

Programming sequence

To access programming menu, press and hold SET button for five seconds.

Display will show “dEb” (deadband)
Press SET again to show current dEb value
Adjust up or down buttons to desired value
Press SET again to show “HdF” (heater differential)
Press SET again to show current HdF value
Adjust up or down buttons to desired value
Press SET again to show AdF (air conditioner differential)
Press SET again to show current AdF value
Adjust up or down buttons to desired value
Press SET again to show CAL (sensor calibration offset)
Press SET again to show current CAL offset value
Adjust up or down buttons to desired value (-10 to +10)

All programmed values are taken into memory upon change. Display will revert to normal operation after 10 seconds of inactivity.

5.3.4.4 **Inhibit adjustment of Heat - A/C ΔT, Heat ΔT, and A/C ΔT**

Inhibit any ΔT adjustment when the resultant A/C ON temperature will become less than “Heat - A/C ΔT” °F above the “Heat OFF” temperature.

5.3.4.5 **Selectable English-Metric Display.**

To change from F to C or C to F, Press F button in upper right corner of controller. "F" or "C" will be displayed in right most digit of three character display. All parameters such as deadband, heat differential, AC differential and calibration offset will remain the same upon F/C conversion.

5.3.4.6 Output 2 will turn OFF and remain OFF for 2 minutes any time power to the Compressor Contactor coil is absent.

5.3.4.7 Output 3 will turn ON (Low Pressure Override) for 2 minutes each time Output 2 is turned ON.

5.3.5 Specifications:

5.3.5.1 Power: 24VAC

5.3.5.2 Accuracy: ±1°F

5.3.5.3 Humidity: 90% non-condensing

5.3.5.4 Temperature

Ambient Operating: -40°F - 150°F
Storage Temperature: -50°F - 185°F

5.3.5.5 Output 1 (Heat)

NO = Relay 1 Normally Open Contact; Contact Rating = 4A, 24VAC resistive
COM = Relay 1 Common
Relay 1 status indicator (LED) – ON when relay is ON; ON when Heating is required.

5.3.5.6 Output 2 (A/C)

NO = Relay 2 Normally Open Contact; Contact Rating = 4A, 24VAC resistive
COM = Relay 2 Common
Relay 2 status indicator (LED) – ON when relay is ON; ON when Cooling is required.

5.3.5.7 Output 3 (Low Pressure Override)

NO = Relay 3 Normally Open Contact; Contact Rating = 1A, 24VAC resistive
COM = Relay 3 Common
Relay 3 is ON for time as specified in 1.13.

5.3.5.8 Input 1 (Compressor Contactor Coil)

Relay 2 will be turned OFF when 24VAC is absent from this input and will turn on after the time specified in 1.12.

6 Maintenance and Repair

6.1 Maintenance Instructions

Preventive Maintenance Checks and Services are essential to ensure that the unit is ready for operation at all times. They correct defects and deficiencies before they can cause serious damage or complete failure of the equipment. Any effective preventive maintenance program must begin with instruction to all operators to report all unusual conditions noted during daily checks or actual operation to the appropriate maintenance personnel.

A system should be established to record all problems, defects, and deficiencies noted by operators and discovered during maintenance inspections together with the corrective actions taken.

A schedule for preventive maintenance inspection and service should be established immediately after installation of the unit. A quarterly interval is recommended for normal operating conditions. Any component requiring preventive maintenance at an interval more than quarterly is specifically identified in Preventive Maintenance Checks and Services Table, Table 6-1. When operating under unusual conditions, such as an extremely dusty, dirty, or sandy environment, it may be necessary to reduce the interval to monthly or less depending on the severity of the environmental conditions.

Stand-by, non-operating units should be rotated on a last in, last out basis. Any unit not operating for one (1) year should be tested. A walk-by, visual inspection should be done monthly. Look for physical damage due to material handling and evidence of oil leakage around the unit. Any unit that shows evidence of physical damage or oil leakage must be tested.

The refrigerant compressor and its drive motor are hermetically sealed. The compressor crankcase has a lifetime supply of oil and is pressure lubricated by an internal oil pump. If compressor failure or motor burnout occurs, the compressor must be replaced. Refer to the Recommended Spare Parts list for the correct replacement part. The evaporator blower motor and the condenser fan motor have double shielded bearings that are permanently lubricated. These bearings are lubricated with a high-grade ball and roller grease of medium consistency and polyurethane base. If a situation occurs where the bearings need lubrication, the bearings must be removed and replaced or repacked with the above referenced lubricant or approved equivalent.

The Preventive Maintenance Checks and Services Table lists the preventive maintenance checks and services that should be performed at quarterly (or otherwise established) intervals. The Preventive Maintenance Checks and Services items in the table have been arranged in a logical sequence to provide for greater personnel efficiency and least amount of required maintenance downtime.

6.2 Service Schedule

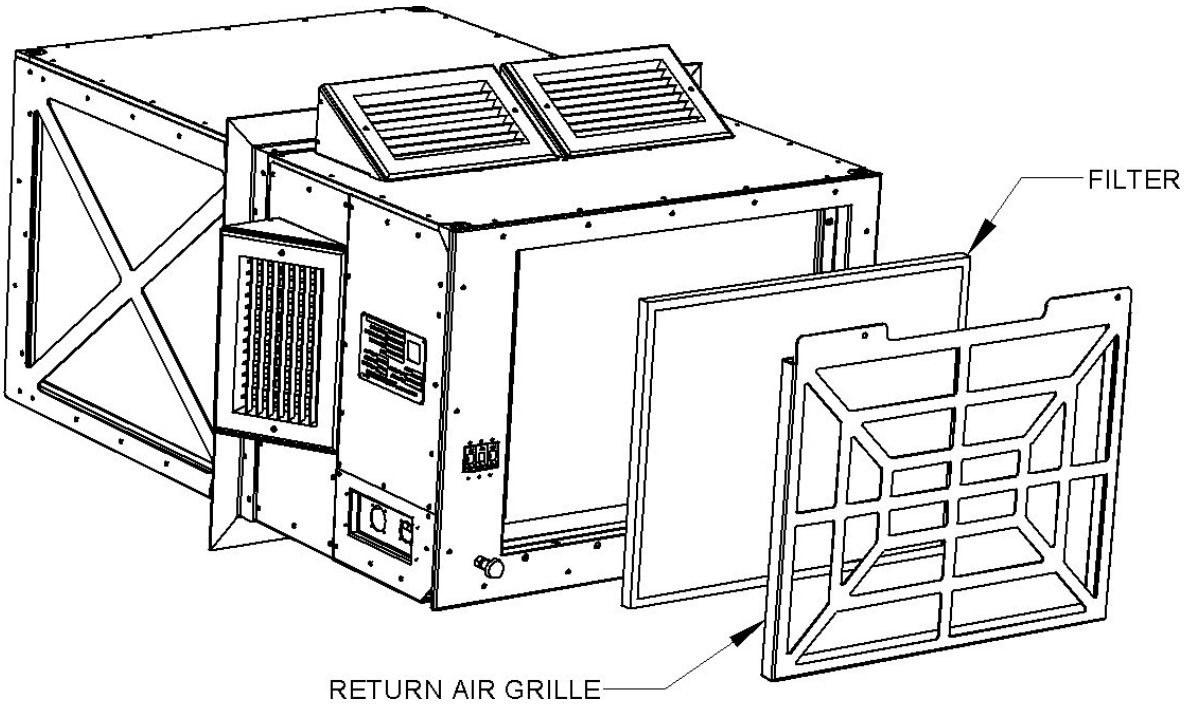
PREVENTIVE MAINTENANCE CHECKS AND SERVICES

TABLE 6.1

Component	PROCEDURES	SERVICE INTERVAL
Return Air Filters	• Remove, Clean, Inspect, and Service • Discard/replace damaged or unserviceable filter.	Monthly
Evaporator and Condenser Coils	• Check for secure mounting. Secure as needed. • Check for bent fins. Straighten with tongue depressor, coil comb, or plastic sheet. • Clean coils as needed.	Quarterly
Fan Motors	• Check for loose electrical connections. Secure as needed. • Check for loose mounting hardware. Secure as needed. • Check for accumulated dust/dirt. Clean as required.	Semi-Annually
Compressor	• Check for loose electrical connections. Secure as needed. • Check for loose mounting hardware. Secure as needed. • Check for accumulated dust/dirt. Clean as required.	Semi-Annually
Refrigeration Components	• Check for loose mounting. Tighten as needed. • Check tubing attachments. Repair as needed. • Inspect for bent or damaged equalizer tubing. Replace as needed. • Check expansion valve bulbs and tubing for damage. Replace as needed. • Check insulation. Repair as needed.	Semi-Annually
Condensate Drain Pan and Hoses	• Check evaporator compartment for evidence of moisture. • Blow out drain line if necessary. (a quart of clean water poured into the condensate pan provides a visual check of the drain line condition)	Semi-Annually
Refrigerant Charge	• Using the sight glass, inspect refrigerant while unit is running in COOL mode. • If low on charge, check for refrigerant leaks, recover refrigerant, repair leak, and recharge system.	Semi-Annually
Electrical Panel and Wiring	• Inspect for damaged insulation, broken connection to lugs and indications of deterioration. Replace and repair as needed.	Semi-Annually

Component	PROCEDURES	SERVICE INTERVAL
Brackets, Mounts, Hardware, etc	• Examine for loose or missing attaching hardware or other obvious damage.	Semi-Annually
Outside Surfaces	• Check outside surfaces for accumulations of dust, dirt, or salt. Clean as required	Quarterly
Sight Glass	• Clean glass • Inspect condition of glass. Replace if cracked	Semi-Annually
Reassemble	• Install all components and panels removed during Preventive Maintenance Checks and Services. • Ensure all components and covers are in place and secure.	As Required

WARNING!
Disconnect the ECU from the power source and remove the power connector from the ECU prior to performing any service or maintenance tasks.



6.2.1 Air Filter Servicing

1. Remove the return air grille.
2. Remove the filter from the ECU.
3. Using a water hose or compressed air, clean in the direction opposite of air flow
4. Allow the filter to dry.
5. Replace the filter into the ECU.
6. Replace the return air grille.

6.2.2 Evaporator Coil Cleaning

1. Remove the top cover and the supply grille.
2. Blow dirt from between fins with air nozzle pointing outward.
3. With damp rag, clean debris from filter compartment.
4. Replace removed panels.

6.2.3 Condenser Coil Cleaning

1. Remove top panel from the condenser section. **DO NOT** remove the "X" side covers as some of the hardware thru this cover secures the coils' mounting.
2. Using compressed air, and working from the inside of the ECU, blow debris from between the fins, pointing the air nozzle upward.
3. Replace top panel.

ATTENTION!
When using compressed air to clean filters or coils, limit pressure to 35 PSI.

ATTENTION!
Do not attempt to make any adjustments or repairs without proper tools.

6.3 Field Repair

It may be necessary from time to time to perform field repairs on the refrigeration system. If field repairs are necessary, the following procedures apply.

ATTENTION!
All repairs must be carried out in compliance with EPA Section No. 608 and applicable local air quality regulations.

6.3.1 Leak Detection

In order to check a system for leaks, it is necessary that the system or portion of the system first be pressurized. This will naturally be true of a new system prior to evacuating and charging, or an old system, which has lost its charge.

If the system has been in operation and has lost its entire charge, it is desirable to pressurize the entire system to find the leak or leaks.

When the entire unit is to be pressurized, it is usually desirable to pressurize the system through both the suction and discharge service valves. In this manner, the pressure is supplied to both the high and low sides of the system.

Refrigeration systems are commonly pressurized for purposes of leak checking with refrigerant and dry nitrogen. Test pressures should be adjusted to 10 psig or higher (Max 150 psig). (Recover all refrigerant)

The advantages of nitrogen are:

- Nitrogen is not ozone depleting.
- It is less expensive than refrigerant.
- Nitrogen will leak approximately twice as fast as refrigerant from the same size hole at the same pressure.
- The valve arrangement on a nitrogen bottle provides an excellent means of checking if a leak exists.
- Nitrogen will not be absorbed by refrigerant oil, thereby causing a misleading pressure drop.
- Test procedures are easier to obtain.

The advantages of refrigerant are:

- Refrigerant leaks can be detected with a Halide or electronic leak detector.
- Nitrogen cannot be detected unless it is used with a portion of refrigerant.
- Refrigerant may be more readily available to a service technician.

Leak Testing a System Charged With Refrigerant Using an Electronic Leak Detector. An electronic leak detector is the preferred tool for leak checking. It is highly sensitive and measures the electronic resistance of gas samples.

- Turn detector on and attach proper probe.
- Pass probe along the lines going around the joints and connections. Be sure to check all points.

- Presence of a leak will be indicated either by a buzzing or beeping sound.

Checking For Leaks With a Soap Solution. Apply a solution of soapy water with a brush or sponge to the joints and connections in the refrigeration line(s). A leak in the lines will cause bubbles to form.

6.3.2 Leak Repair

When a leak is located, properly reclaim the remaining refrigerant charge before attempting repairs. Adjacent piping must be thoroughly cleaned by removing all paint, dirt and oily film. Use a wire brush, sand cloth or sandpaper and wipe the area with clean, dry cloths. Protect nearby parts from heat damage by wrapping with water-soaked cloths.

For copper-to-copper (piping) repairs, use SILFOS Alloy. No flux is required with Silfos Alloy. Silver solder (Stay-Silv #45) and flux are to be used on copper-to-brass or copper-to-steel repairs. In an emergency, a 95%/5% tin/antimony solder may also be used with flux for repairs. When repairs are completed, remove all traces of flux. After any repair, check for leaks prior to system use.

WARNING!
DEATH or serious injury may result if personnel fail to observe the following safety precautions

- Great care must be exercised to prevent contact of liquid refrigerant or refrigerant gas discharged under pressure, with any part of the body. The extremely low temperature resulting from the rapid expansion of liquid refrigerant, or refrigerant gas released under pressure, can cause sudden and irreversible tissue damage through freezing.

- As a minimum, all personnel must wear thermal protective gloves and face shield or goggles when working in any situation where refrigerant contact with the skin or eyes is possible. Application of excessive heat to any component in a charged system will cause extreme pressure that may result in a rupture, possibly explosive in nature.

- Exposure of Refrigerant R-134a to an open flame or a very hot surface will cause a chemical reaction in the gas to form hydrofluoric acid, a highly poisonous and corrosive gas.

- In its natural state. Refrigerant R-134a is a colorless odorless vapor with no toxic characteristics. It is heavier than air and in a well-ventilated area will disperse rapidly. However, in an unventilated area it will displace oxygen and presents a danger as a suffocative.

6.3.3 Compressor Replacement

The compressor is the most important component of the air conditioner. Numerous safety devices are provided to protect the compressor from contamination damage and burnout.

ATTENTION!
When replacing a burned-out compressor, it is mandatory that the refrigeration system be thoroughly cleaned before operating the replacement compressor.

When a compressor burnout occurs, acid is created as a result of refrigerant-oil mixture being exposed to the extreme high temperatures the motor burnout generates. The acid diffuses throughout the refrigeration system and must be removed before a new compressor is placed in service, or the acid will attack the windings of the new compressor motor. Any dirt, scale, air or water vapor also drastically shortens the operating life of the new compressor.

To replace the compressor, a qualified technician can observe the following procedure:

1. Unsolder the suction and discharge lines from the compressor. Remove and retain the hardware that mounts the compressor to the ECU. Remove the compressor from the ECU.

2. Test the refrigerant oil of the defective compressor for acid using an acid test kit. If the refrigerant oil is found to be acidic, replace the liquid line filter/drier and a suction line filter/drier. If the analysis of the oil shows no acidity, then the system can be cleaned by simply replacing the liquid line filter/drier.

3. Install the new compressor using the hardware removed from the defective compressor. Re-solder the suction and discharge lines. Make all electrical connections to the compressor.

4. Purge the system with dry nitrogen then add a holding charge of Refrigerant R-134a. Refer to the leak detection section of this manual (6.3.1) and perform a leak check.

5. Once the unit has passed the leak detection test, evacuate the refrigeration system to 50 microns of vacuum. Then break the vacuum with R-134a refrigerant.

6. Charge and operate unit.

7. After installation and start-up are complete, the following tests should be performed on the replacement compressor and the information recorded.
    - Suction & Discharge pressures
    - Amp draw.

6.3.4 Compressor Burnout Decontamination Procedure

When a motor burnout occurs in the compressor, the resulting high temperature arc causes a portion of the refrigerant/oil mixture to break down into carbonaceous sludge, corrosive acid, and water. Contamination resulting from a burnout can result in repeat failures if the contaminants are allowed to reach and remain in the crankcase of the replacement compressor. This situation can be prevented by following the proper clean-up procedures after a burnout. NAI recommends the filter-drier cleaning procedure. Basically this involves the use of approved filter-driers incorporating an adequate desiccant (not a filter only) in both the liquid and suction lines.

WARNING!
Use rubber gloves and safety glasses and ventilate the workspace. The oil from a burnout could cause serious skin irritation and possibly burns. In some cases, the fumes are toxic.

1. In order to avoid losing refrigerant to the atmosphere, you must recover refrigerant using standard recovery procedures and equipment. At that point, remove the inoperative compressor and install the replacement.

2. Since the normal color of refrigerant oil varies from oil to oil, take a sample of oil from the replacement compressor and seal in a small glass bottle for comparison purposes after the cleaning operation is complete. Suitable two ounce bottles are obtainable at any drug store.

3. Evacuate the system, following the procedures previously recommended. Perform the inspections and filter-drier changes listed in Steps 4 and 5, and charge through a filter-drier with the refrigerant that was removed and recovered. Add additional refrigerant as necessary.

4. Although some contaminants will be returned to the compressor during the pump down procedure, the compressor will not be harmed by the short period of operation required, and the contaminants will be removed as they are circulated through the system after the installation of the filter-drier.

5. Inspect all system controls such as expansion valves, solenoid valves, check valves, contactors, etc. replace the filter-drier previously installed in the system.

6. Install the recommended size filter-drier in the liquid line. Charge through a filter-drier with the refrigerant, which was removed and recovered. Add additional refrigerant as necessary.

7. Start the compressor and put the system in operation. As the contaminants in the system are filtered out, the pressure drop across the filter-drier will increase. Observe the pressure differential across the filter-drier for a minimum of four (4) hours, preferably by means of one gauge and a manifold to eliminate gauge error. If the pressure drop exceeds seven (7) pounds, replace the filter-drier and restart the system.

8. After the completion of Step 6, allow the unit to operate for 48 hours. Check the odor (warning: smell cautiously) and compare the color of the oil with the sample taken in Step 2. If an acid test is available, test for acid content. If the oil is discolored, has an acrid odor, is acidic, or if the moisture indicator indicates high moisture content in the system, change the filter-drier. The compressor oil can be changed if considered desirable. Allow the system to operate for an additional 48 hours, and recheck as before. Repeat until the oil remains clean, odor free and the color approaches that of the original sample.

9. Replace the liquid line filter-drier with one of the normally recommended size.

10. After the cleaning procedure is completed, recheck after approximately 50 hours of operation to insure that the system condition and operation is completely satisfactory.

6.3.5 Refrigeration System Component Replacement

The expansion valve, solenoid valve, filter/drier, etc. can be readily replaced by any qualified refrigeration service technician following standard refrigeration procedures.

Refer to the wiring diagram and refrigeration schematic in Section 8 of this manual for the location of the system components and their relationship to each other. Refer to any adjustments and settings that may be required before or after installation.

To attaching a manifold hose to Schrader valve:

1. Remove cap from valve.

2. Make sure gauge manifold valves are closed.

3. If hose does not have an unseating pin, unseating coupler must be used.

4. Make sure coupler is lined up straight with Schrader valve. Screw coupler on to valve.

5. Open gauge manifold valve slightly and purge air from hose with refrigerant.

6. Read the suction pressure on compound gauge and head pressure on pressure gauge.

7. To remove, push end of coupler tight against end of Schrader valve and hold in place while quickly unscrewing coupler nut from Schrader valve.

8. Remove coupler from Schrader valve.

Evacuate the system to less than 500 microns, using a good vacuum pump and an accurate high vacuum gauge. Operate the pump at 500 microns, or less, for several hours and then allow the system to stand for several additional hours to be sure the vacuum is maintained.

ATTENTION!

A refrigeration system should be evacuated whenever the system has been open in such a manner that there is a possibility that air and moisture could have entered the system. The evacuation process is intended to remove non-condensable gases and moisture from the portion of the system to be evacuated. The most important contaminant to be removed is moisture. To remove moisture from the system, it must first be boiled into vapor. Before water will boil at ordinary room temperature, for example, at 70°F the vacuum must be 29¼ inches of mercury at 30 inches of mercury barometric pressure. This means that the system must be within ¾ inches of mercury of absolute zero pressure. This low vacuum should be measured by using an absolute pressure gauge, such as an electronic gauge. For this reason, a good vacuum pump must be used to accomplish good dehydration.

An alternate method of removing moisture and non-condensables from the system is:

1. Evacuate the system to 29 inches vacuum for ten minutes per ton of system.

2. Break the vacuum with refrigerant to be used for final charging of system and vapor charge in system for a minimum of five minutes.

3. Repeat Step (1) two more times.

4. Evacuate system to 29 inches vacuum for twenty minutes per ton. Charge system with the specified kind of quantity of refrigerant (charge into vacuum).

5. Disconnect charging line at vacuum and connect to refrigerant supply. Crack valve and purge charging line at center on manifold. Then close valve.

6. The system is now ready for the correct operating charge of refrigerant.

6.3.6 Charging Procedures

If the system has been open to the atmosphere, it should be first evacuated (Section 6.3), and then may be charge with this general procedure:

1. Attach a drum of proper, clean refrigerant to the center port of the charging manifold with one of the charging hoses.

2. Attach a second charging hose to the suction gauge (low-pressure) side of the gauge manifold.

3. Remove the cap from the suction line valve.

4. Loosely attach the suction gauge hose to the line valve. Open the valve on the refrigerant drum and the suction valve on the charging manifold slightly to purge the air from the manifold and hoses before tightening the fitting.

5. Attach the third hose to the high-pressure side of the manifold and the liquid line valve. Repeat Steps 3 and 4 above.

6.3.7 Charging the System by Weight

It is preferable to charge the system by refrigerant weight. If a proper scale is available, this procedure may be used to charge the ECU.

1. Close the hot gas by-pass ball valve found in the condenser compartment.

2. Connect the manifold as instructed.

3. Place the refrigerant drum on a scale and determine exact weight of refrigerant and cylinder or use a Charging cylinder. Refer to Data Plate for proper charge.

4. With manifold suction valve closed and manifold discharge valve open, open refrigerant cylinder valve and allow pressure in system to balance with pressure of cylinder.

5. When there is approximately a full charge, close the discharge manifold valve and let the system stabilize for about five minutes.

6. Start compressor by setting thermostat.

7. When the correct weight of refrigerant has been added to the unit, close refrigerant cylinder valve and allow unit to run for 30 minutes. Check the head pressure and sight glass and adjust charge if needed.

8. Front seat gauge manifold valves, disconnect charging and gauge hoses and replace all valve caps.

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CHAPTER 6

SUPPLEMENTAL MAINTENANCE PARAGRAPHS

AIR CONDITIONER MOTOR REPLACEMENT 6.4

THIS WORK PACKAGE COVERS:

INITIAL SETUP:

Maintenance Level
Field

Equipment Conditions
A/C unit removed (para 6.22)
A/C discharged (para 11)
A/C panel(s) removed (para 6.24)

Tools and Special Tools
Genl Mech Tool Kit (5180-01-454-3787)
Tool Kit, Electrical (NSN 5180-00-876-9336)

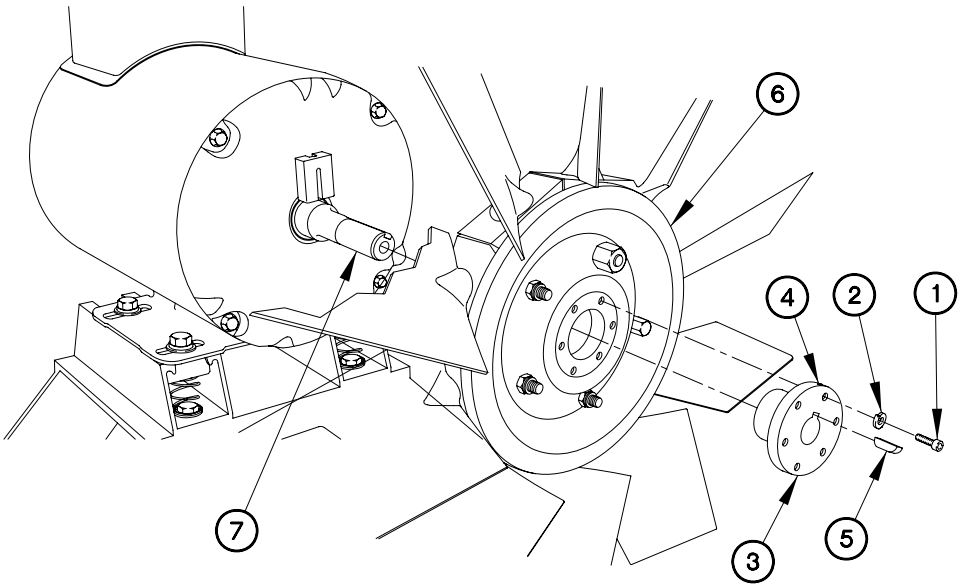
Tools and Special Tools (Cont)
Dispenser, Pressure Sensitive Adhesive Tape (NSN 7520-01-209-1152)

Follow-On Maintenance
Replace air dryer (para 6.5)
Bench test A/C (para 6.25)
Install A/C panel(s) para 6.24)
Install A/C unit (para 6.22)

Parts Figure
Figure 230-00018-A1

Removal

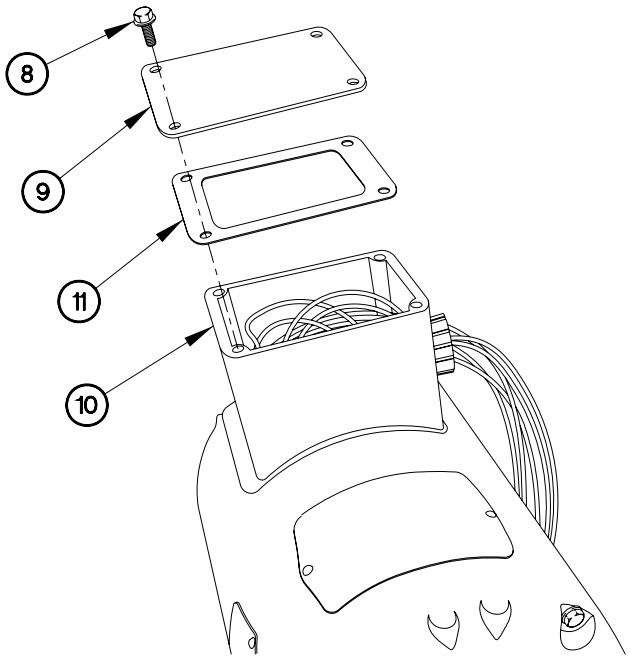
1. Remove three screws (1) and lockwashers (2) from retaining ring (3). Discard lockwashers.
2. Loosen setscrew (4) on retaining ring (3).
3. Remove retaining ring (3), key (5), and fan (6), from shaft (7).



EVAC604I01

Removal (Continued)

4. Remove four screws (8) and cover (9) from electrical box (10).
5. Remove gasket (11) from cover (9). Discard gasket.



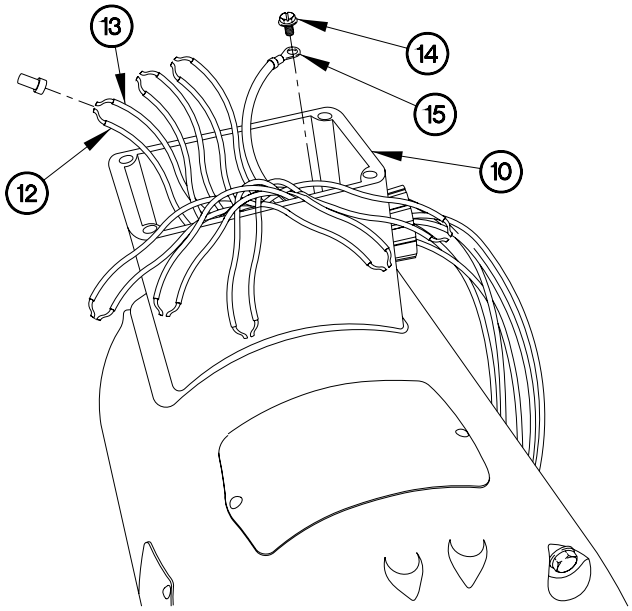
EVAC604X01

Removal (Continued)

NOTE

Tag electrical connectors and connection points prior to removal

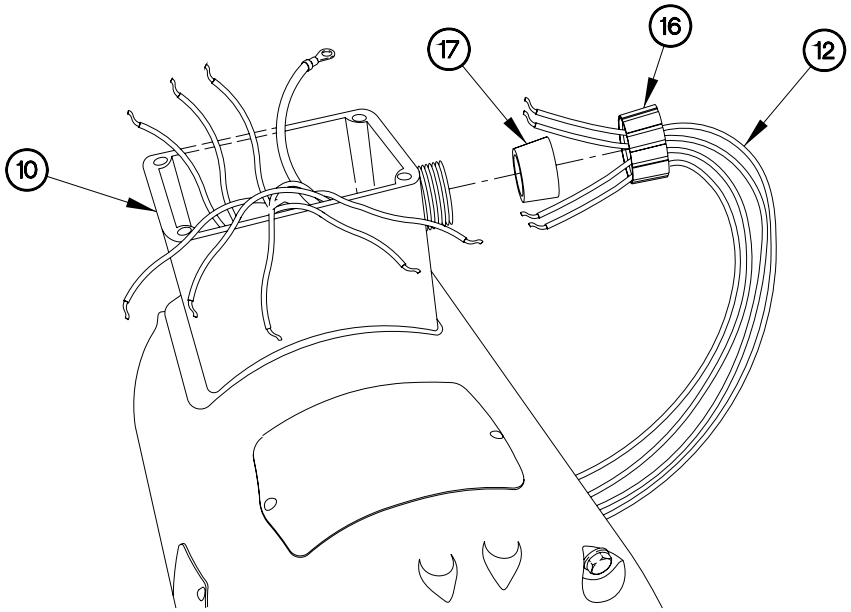
6. Disconnect eight electrical wires (12) from wires (13).
7. Remove screw (14) and ground terminal (15) from electrical box (10).



EVAC604X02

Removal - Continued

8. Remove nut (16), grommet (17), and eight electrical wires (12) from electrical box (10).



EVAC604X03

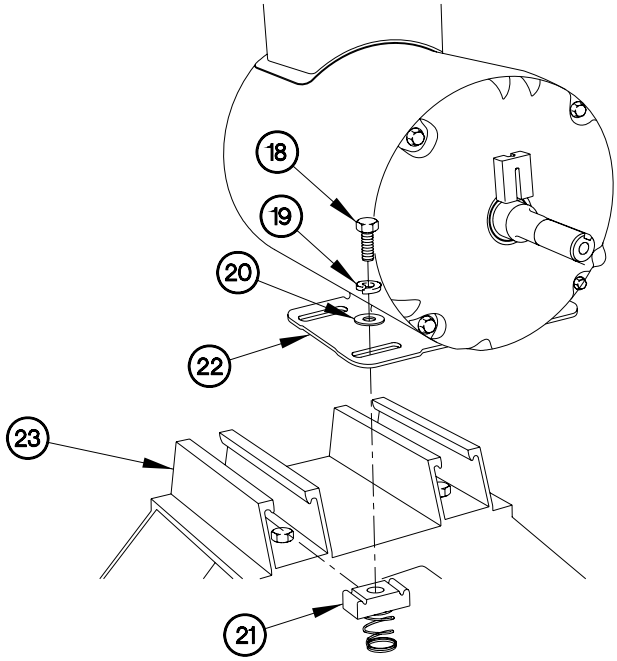
Removal - Continued

NOTE

Note position of motor on two struts prior to removal.

9. Remove four bolts (18), lockwashers (19), washers (20), and spring nuts (21) from motor (22).

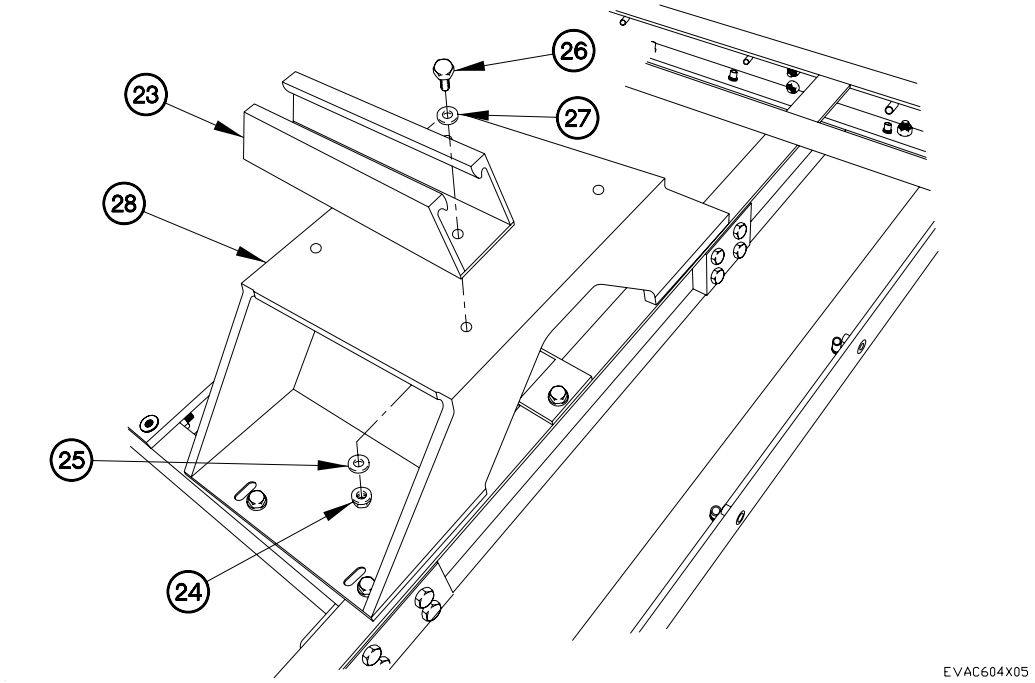
10. Remove motor (22) from two struts (23).



EVAC604X04

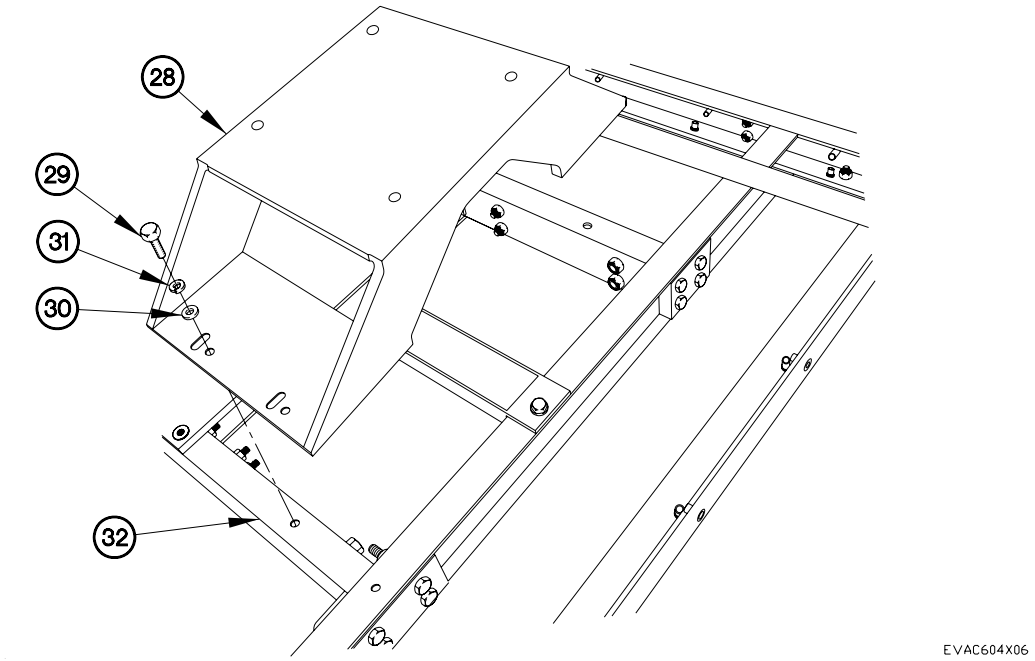
Removal – Continued

11. Remove four self-locking nuts (24), washers (25), bolts (26), washers (27), and two struts (23) from upper frame (28). Discard self-locking nuts.



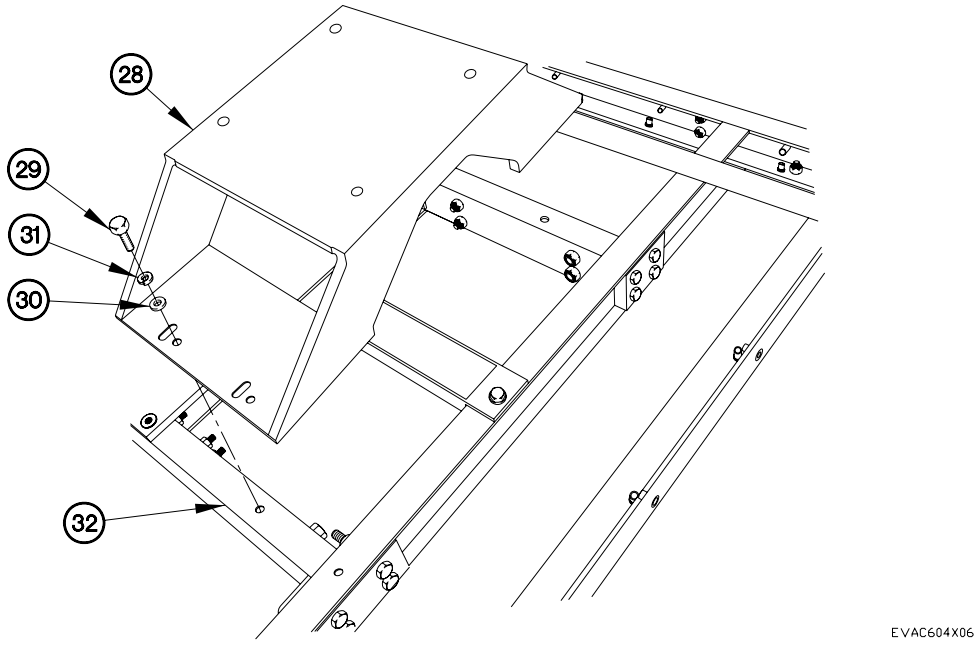
Removal – Continued

12. Remove four bolts (29), washers (30), lockwashers (31), and upper frame (28) from body (32). Discard lockwashers.

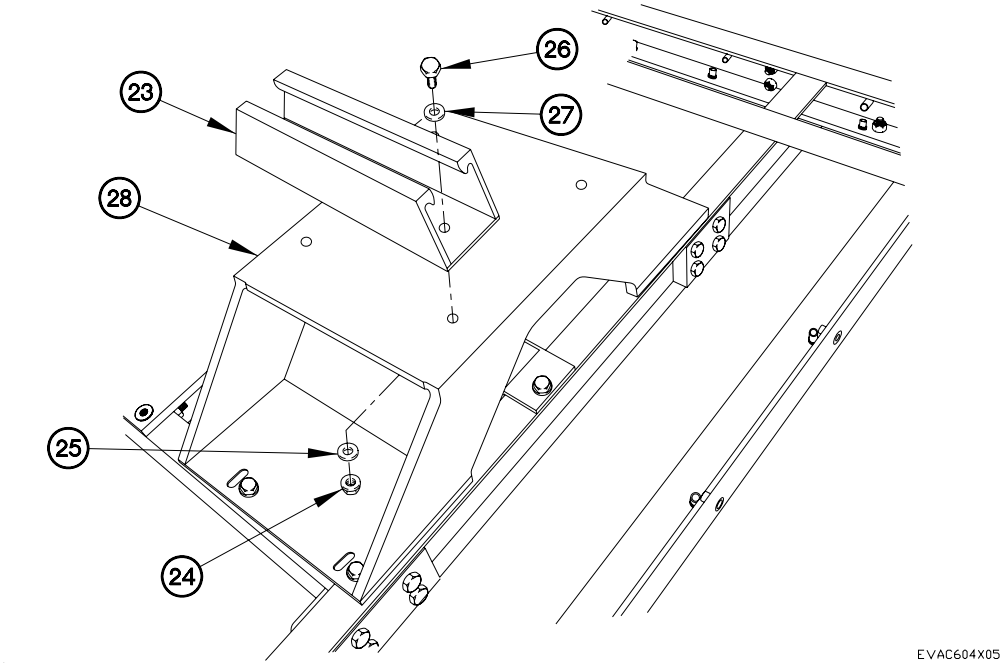


Installation

1. Install upper frame (28) on body (32) with four lockwashers (31), washers (30) and bolts (29).



2. Install two struts (23) on upper frame (28) with four washers (27), bolts (26), washers (25), and self-locking nuts (24).

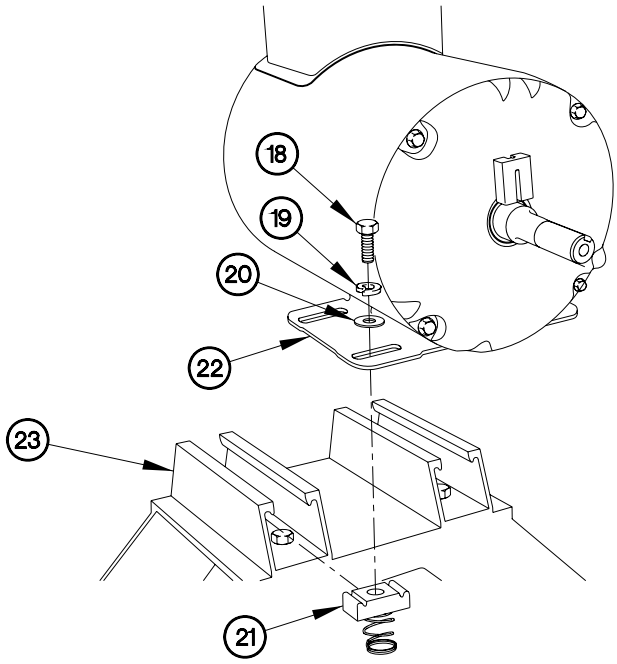


Installation - Continued

NOTE

Use position of motor on two struts noted during removal.

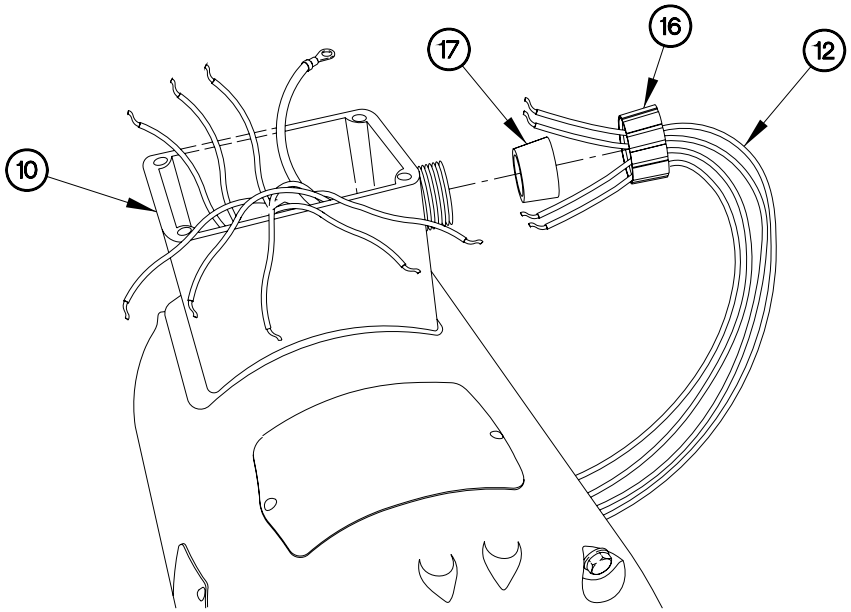
3. Install motor (22) on two struts (23) with four spring nuts (21), washers (20), lockwashers (19), and bolts (18).



EVAC604X04

Installation - Continued

4. Install eight electrical wires (12) in electrical box (10) with grommet (17) and nut (16).

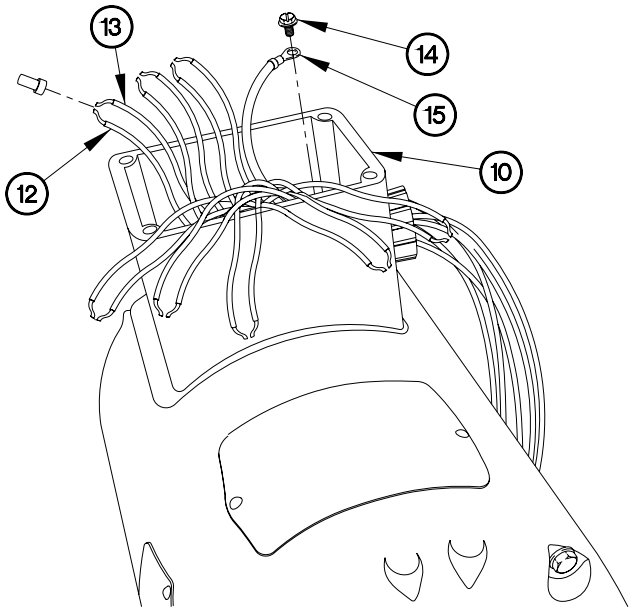


EVAC604X03

Installation - Continued

5. Install ground terminal (15) in electrical box (10) with screw (14).

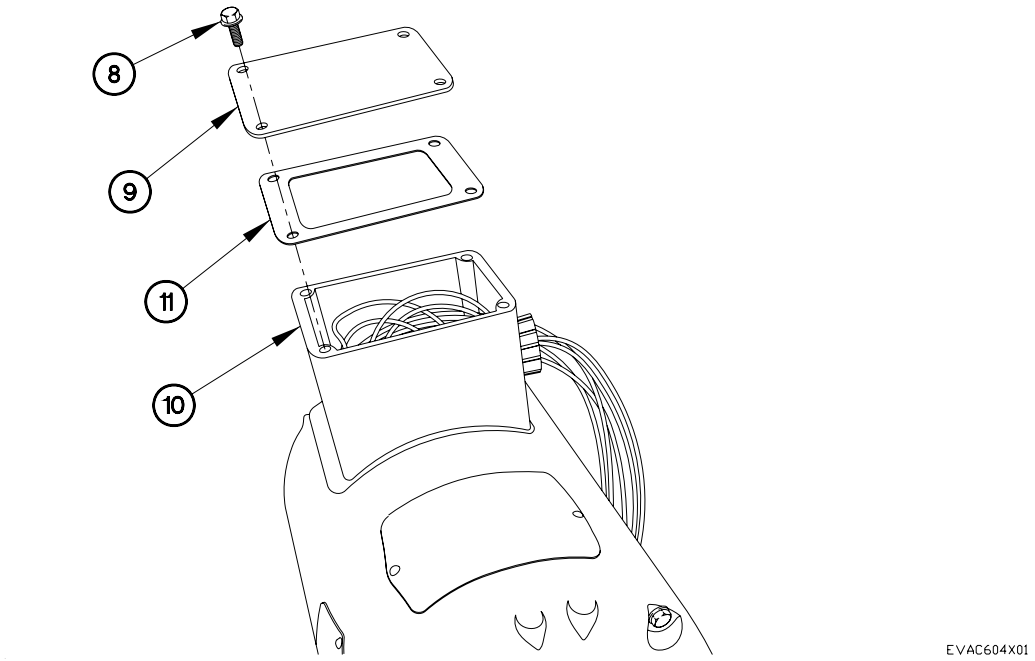
6. Connect eight electrical wires (12) to wires (13).



EVAC604X02

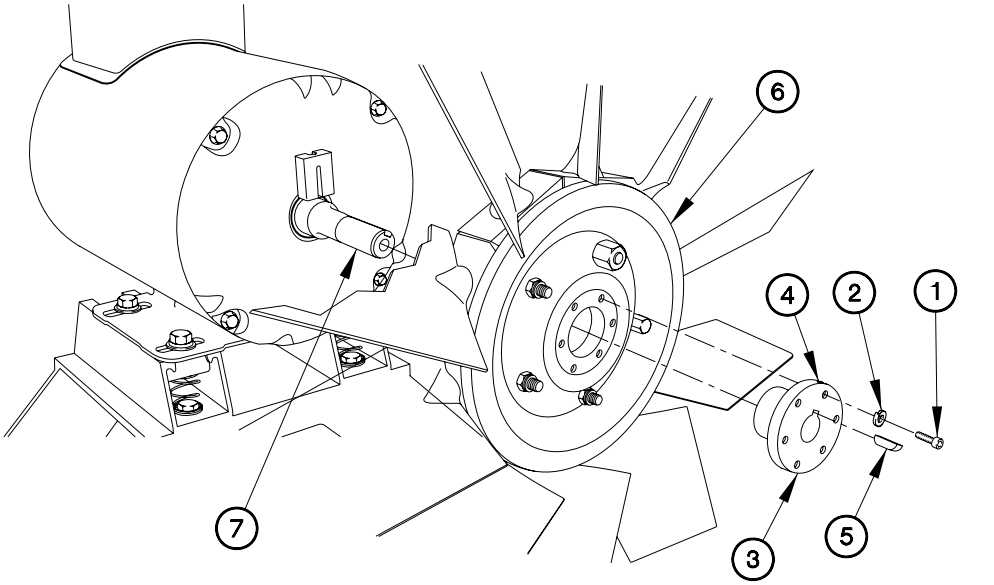
Installation - Continued

7. Install gasket (11) and cover (9) on electrical box (10) with four screws (8).



Installation - Continued

8. Install fan (6) and key (5) on shaft (7) with retaining ring (3).
9. Tighten setscrew (4) on retaining ring (3).
10. Install three lockwashers (2) and screws (1) in retaining ring (3).



END OF WORK PACKAGE.

AIR DRYER AND SIGHT GLASS REPLACEMENT 6.5

THIS WORK PACKAGE COVERS:

INITIAL SETUP:

Maintenance Level
Field

Equipment Conditions
A/C unit removed (para 6.22)
A/C discharged (para 11)
A/C motor removed (para 6.4)

Tools and Special Tools
Genl Mech Tool Kit (NSN 5180-01-454-3787)
Tool Kit, Refrigeration (SC 5180-95-N18

Mandatory Replacement
Air Dryer (P/N 021-00001)

Follow-On Mainenance
Charge A/C (para 11)
Install A/C motor (para 6.4)
Bench test A/C (para 6.25)
Check for leaks (para 6.27)
Install A/C unit (para 6.22)

Parts Figure
Figure 230-00018-APJ

WARNING

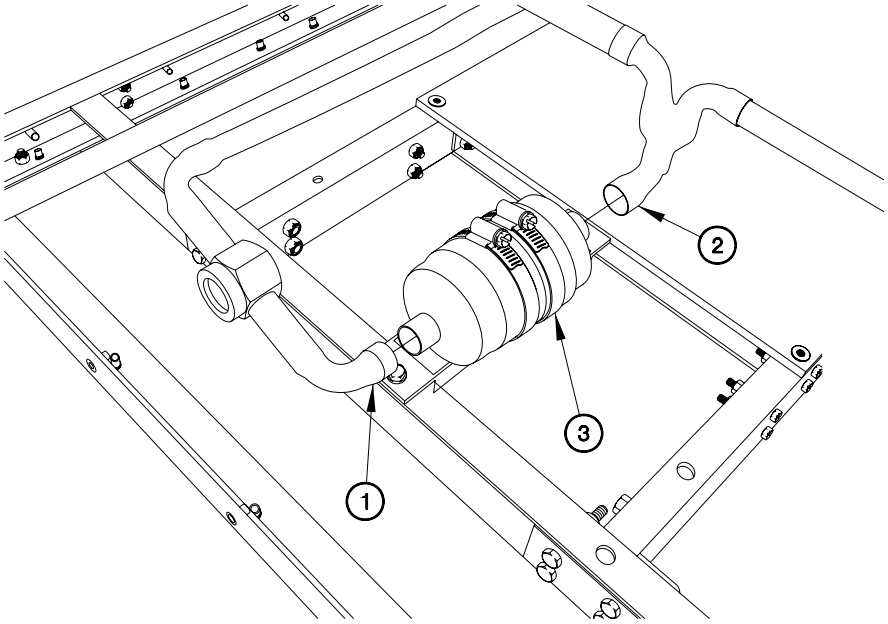
Use caution when heating copper tubing or working with a torch. Ensure area around copper tubing is clear or protected prior to heating. Failure to comply may result in serious injury to personnel or damage to equipment.

Removal

NOTE

Air dryer should be replaced any time the system has been evacuated.

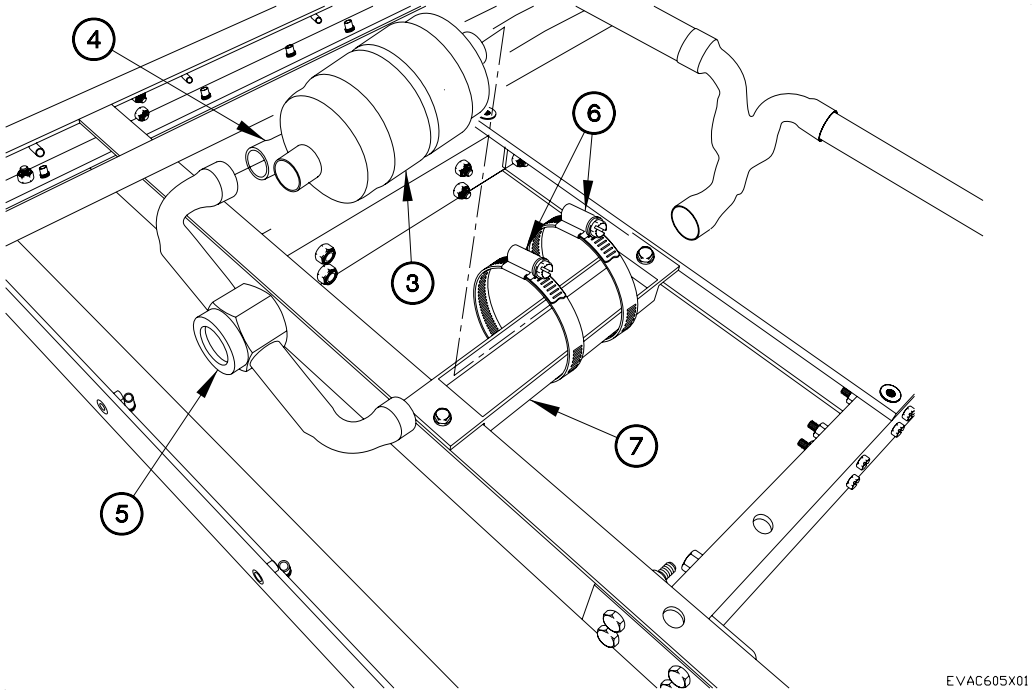
1. Heat tubing (1 and 2) on air dryer (3).
2. Remove tubing (1 and 2) from air dryer (3).



EVAC605R01

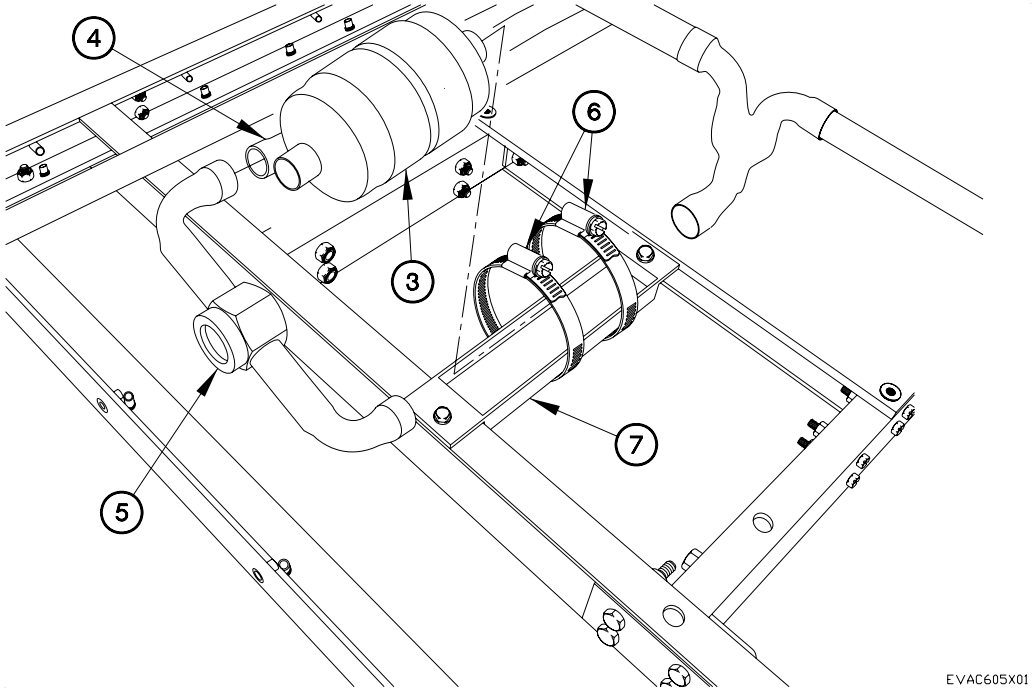
Removal (Continued)

3. Heat tubing (4) on sight glass (5).
4. Remove sight glass (5) from tubing (4).
5. Loosen two clamps (6) from air dryer (3).
6. Remove air dryer (3) from body (7). Discard air dryer.



Installation

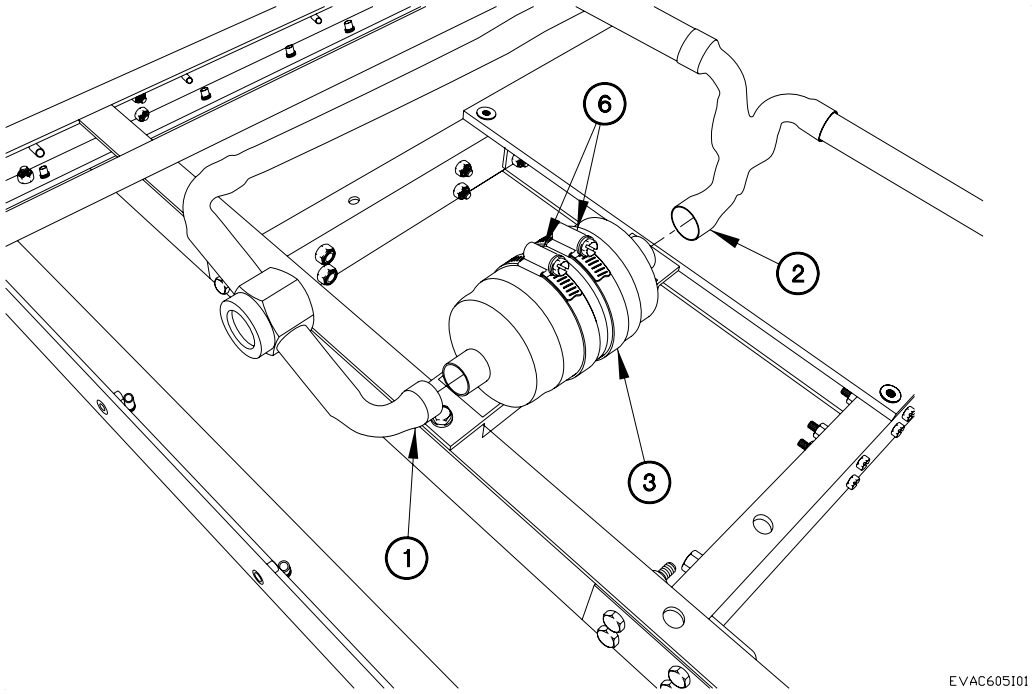
1. Position air dryer (3) in two clamps (6) on body (7).
2. Install sight glass (5) on tubing (4).
3. Brazen tubing (4) to sight glass (5).



Installation – Continued

4. Brazen tubing (1 and 2) to air dryer (3).

5. Tighten two clamps (6).



END OF WORK PACKAGE.

BYPASS VALVE REPLACEMENT 6.6

THIS WORK PACKAGE COVERS:

INITIAL SETUP:

Maintenance Level
Field

Equipment Conditions
A/C unit removed (para 6.22)
A/C discharged (para 11)
Panel(s) removed (para 6.24)

Tools and Special Tools
Genl Mech Tool Kit (NSN 5180-01-454-3878)
Tool Kit, Refrigeration (SC 5180-95-N18)

Follow-On Maintenance
Replace air dryer (para 6.5)
Charge A/C (para 11)
Bench test A/C (para 6.25)
Check for leaks (para 6.27)
Install panel(s) (para 6.24)
Install A/C unit (para 6.22)

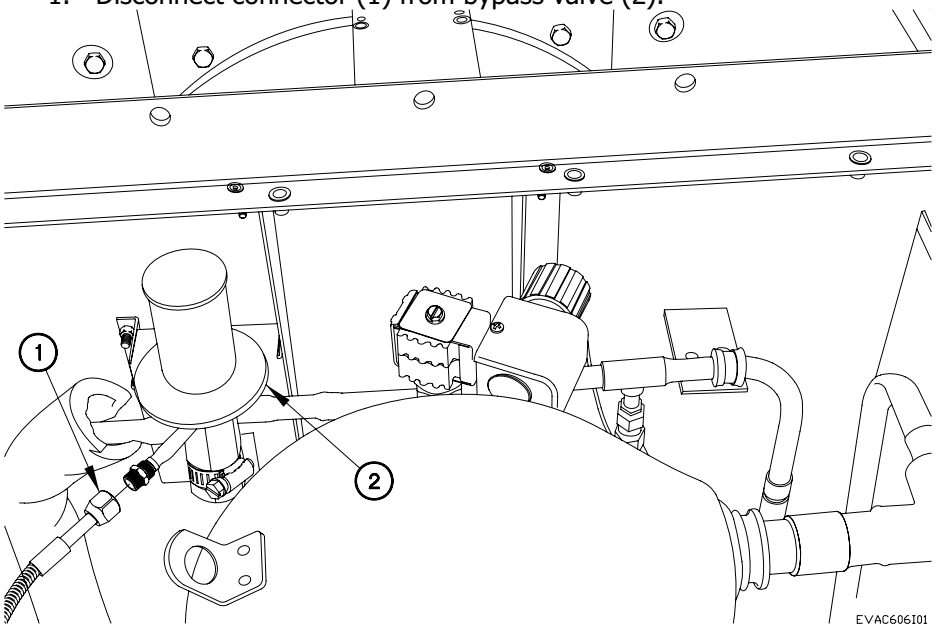
Parts Figure
Figure 230-00018-AP

WARNING

Use caution when heating copper tubing or working with a torch. Ensure area around copper tubing is clear or protected prior to heating. Failure to comply may result in serious injury to personnel or damage to equipment.

Removal

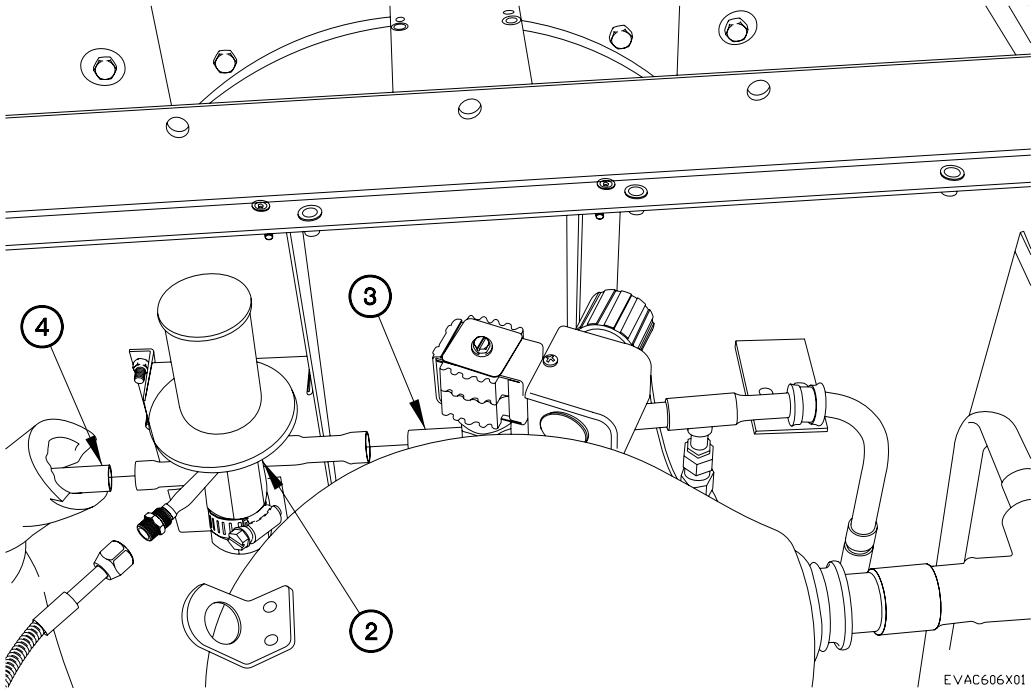
1. Disconnect connector (1) from bypass valve (2).



Removal (Continued)

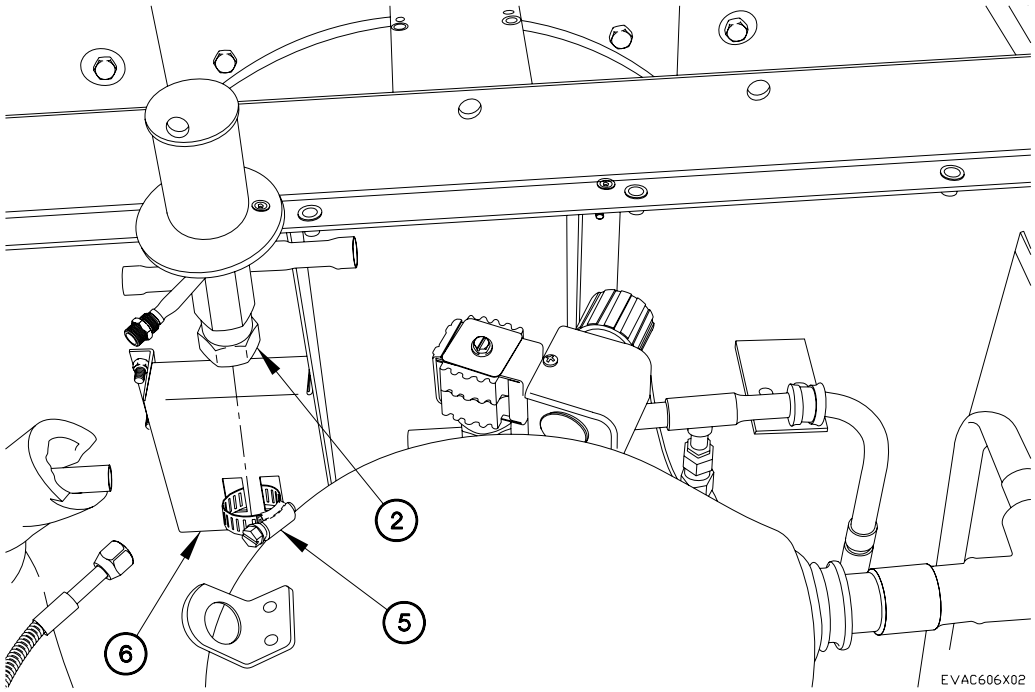
2. Heat tubing (3 and 4) on bypass valve (2).

3. Remove tubing (3 and 4) from bypass valve (2).



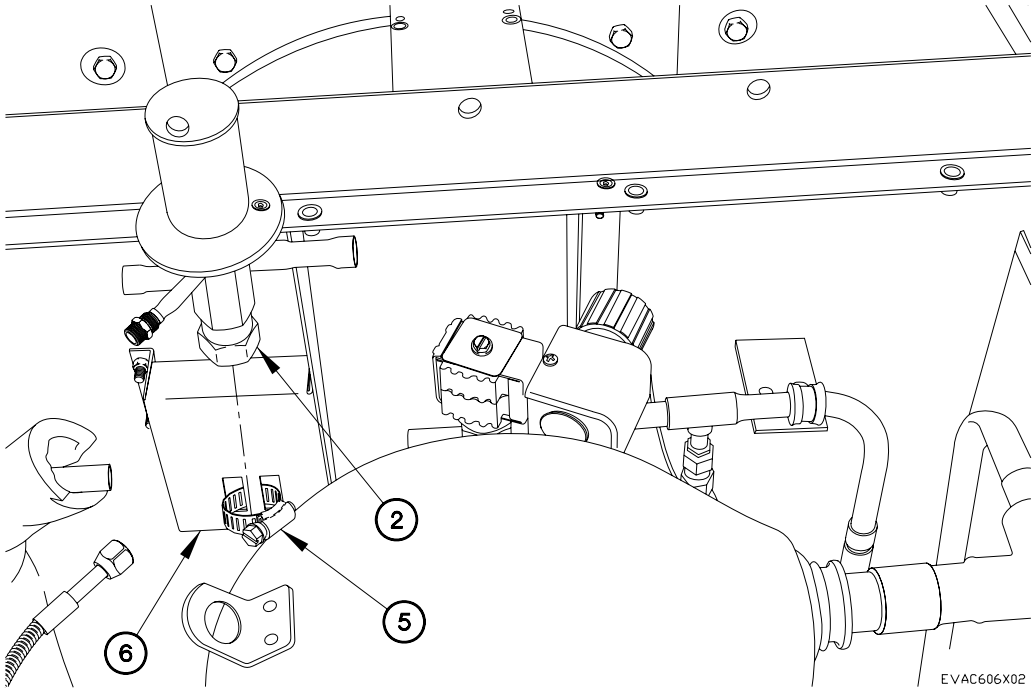
Removal (Continued)

4. Loosen clamp (5) on bypass valve (2).
5. Remove bypass valve (2) from body (6).



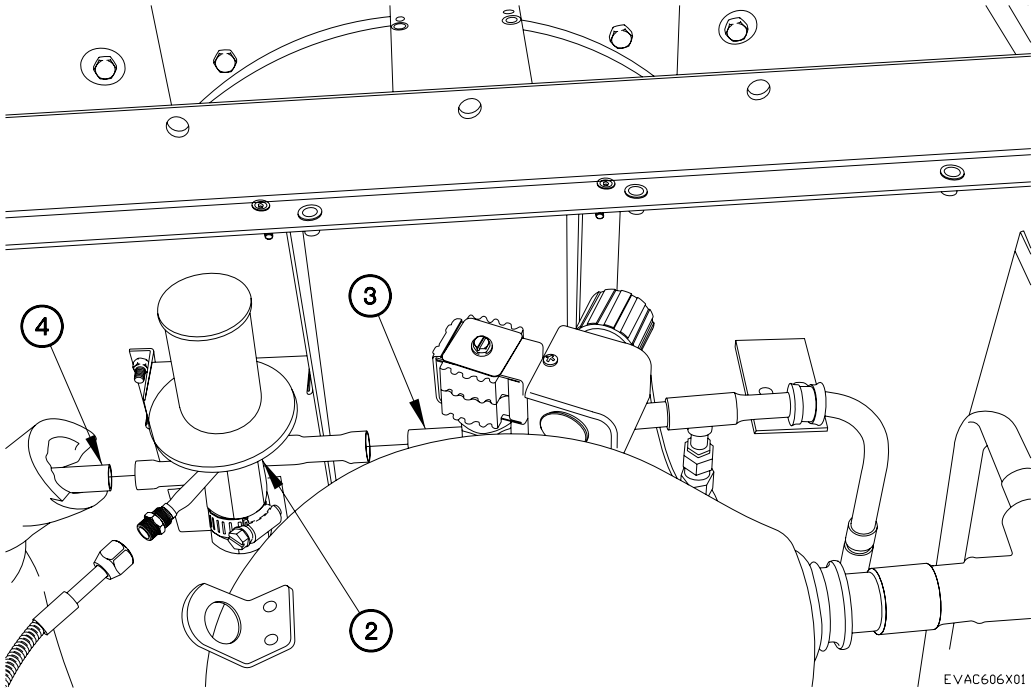
Installation

1. Install bypass valve (2) on body (6) with clamp (5).



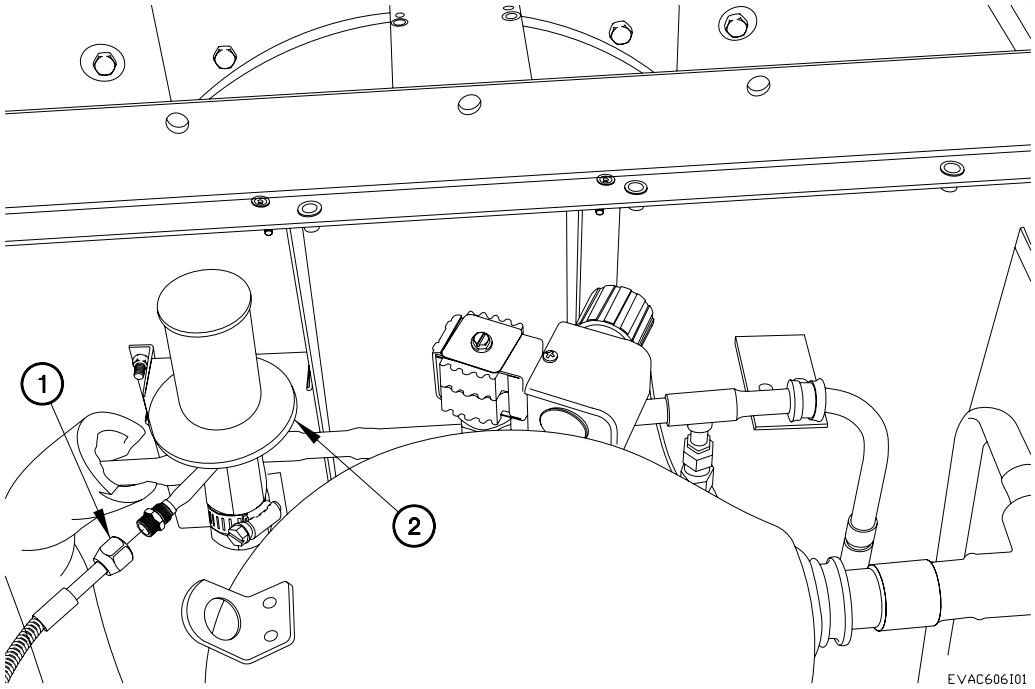
Installation (Continued)

2. Install tubing (3 and 4) on bypass valve (2).
3. Brazen tubing (3 and 4) on bypass valve (2).



Installation (Continued)

4. Connect connector (1) to bypass valve (2).



END OF WORK PACKAGE.

BYPASS VALVE SOLENOID REPLACEMENT 6.7

THIS WORK PACKAGE COVERS:

INITIAL SETUP:

Maintenance Level
Field

Equipment Conditions
A/C unit removed (para 6.22)
A/C discharged (para 11)
Panel(s) removed (para 6.24)

Tools and Special Tools
Genl Mech Tool Kit (NSN 5180-01-454-3787)
Tool Kit, Refrigeration (SC 5180-95-N18
Tool Kit, Electrical (NSN 5180-00-876-9336)

Mandatory Replacement
Seal Kit (NSN 5330-00-966-8657)

Follow-On Mainenance
Replace air dryer (para 6.5)
Charge A/C (para 11)
Bench test A/C (6.25)
Check for leaks (6.27)
Install panel(s) (para 6.24)
Install A/C unit (para 6.22)

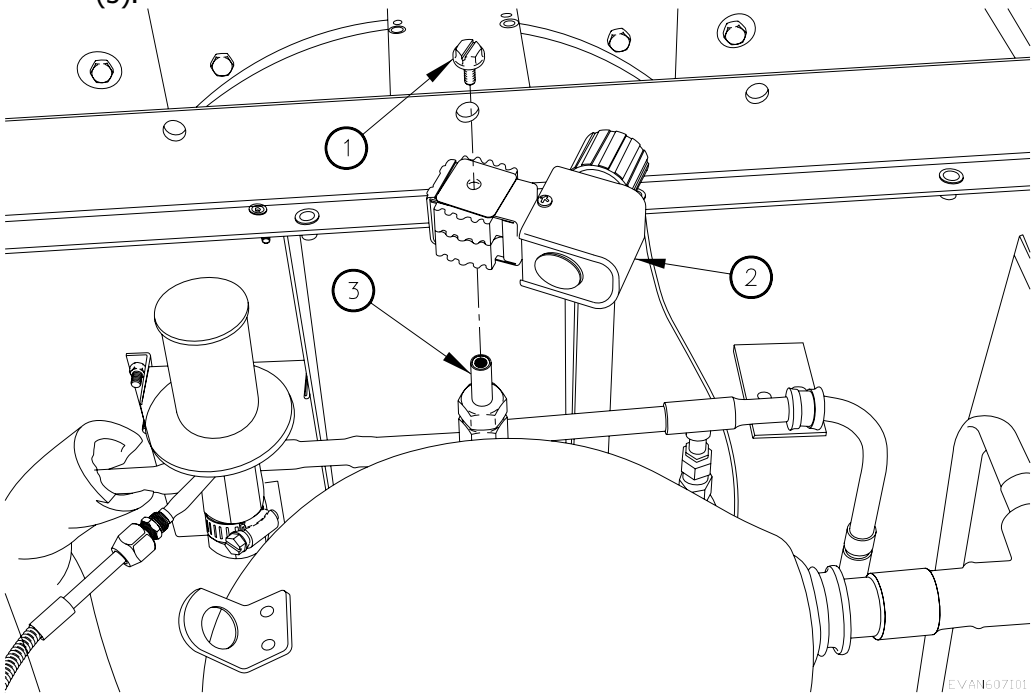
Parts Figure
Figure 230-00018-AP

WARNING

Use caution when heating copper tubing or working with a torch. Ensure area around copper tubing is clear or protected prior to heating. Failure to comply may result in serious injury to personnel or damage to equipment.

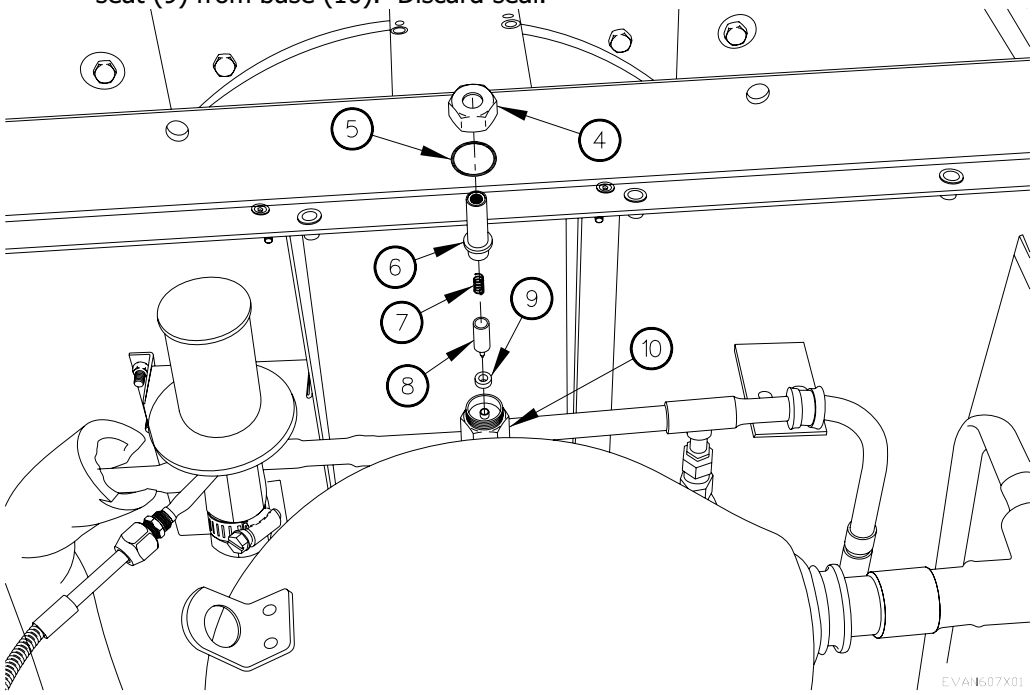
Removal

1. Remove screw (1) and bypass valve solenoid housing (2) from needle valve (3).



Removal (Continued)

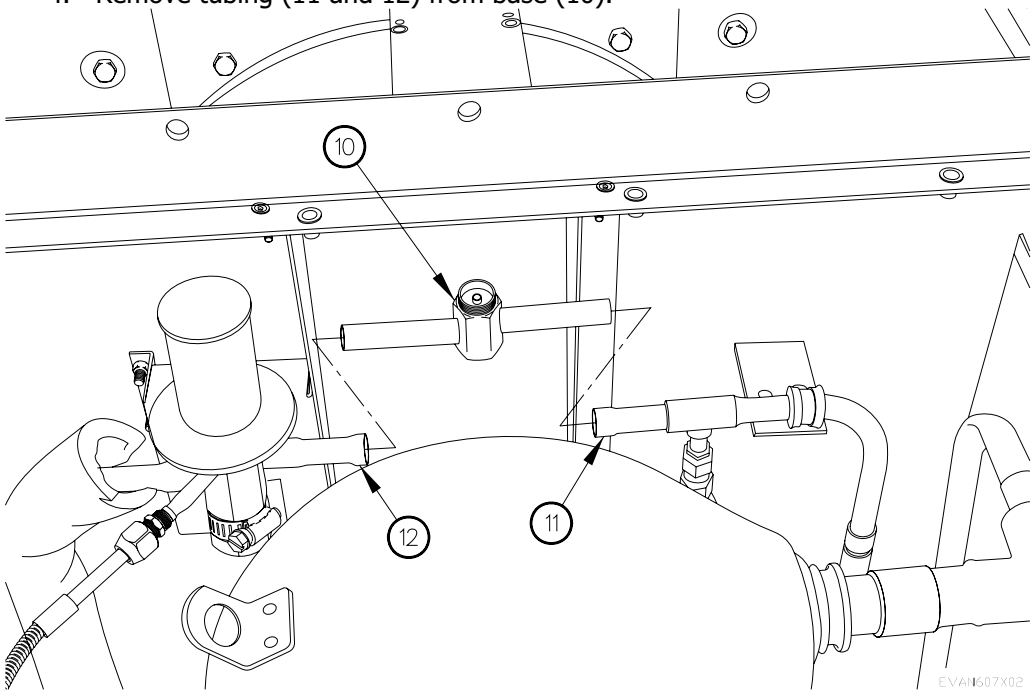
2. Remove nut (4), seal (5), housing (6), spring (7), needle valve (8) and needle seat (9) from base (10). Discard seal.



Removal (Continued)

3. Heat tubing (11 and 12) on base (10).

4. Remove tubing (11 and 12) from base (10).



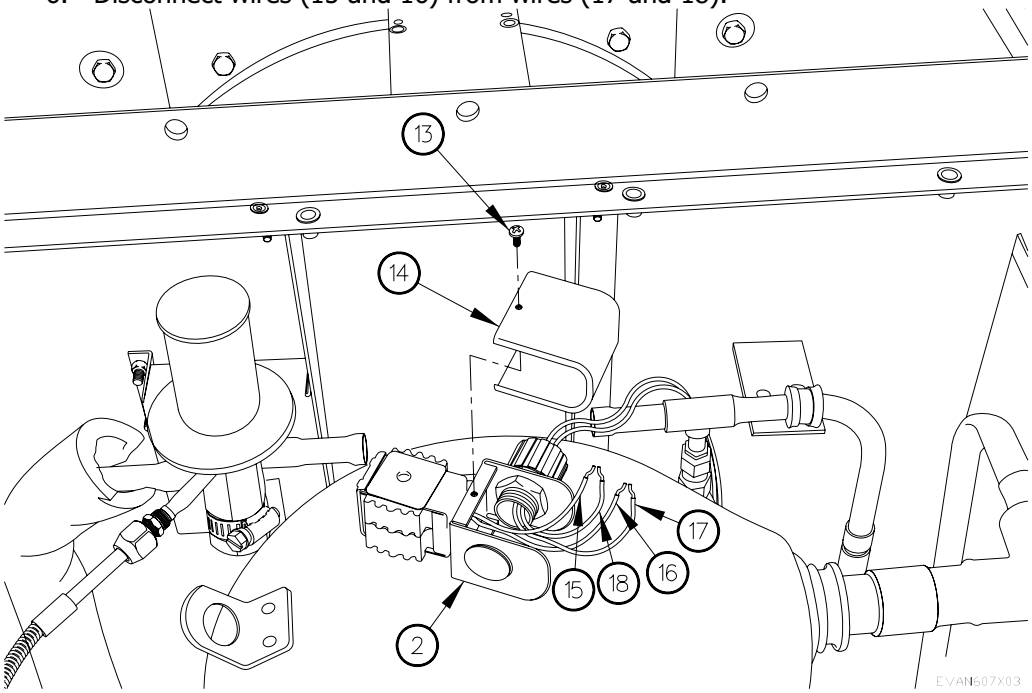
Removal (Continued)

5. Remove screw (13) and case (14) from bypass valve solenoid housing (2).

NOTE

Tag electrical connectors and connection points prior to disconnection.

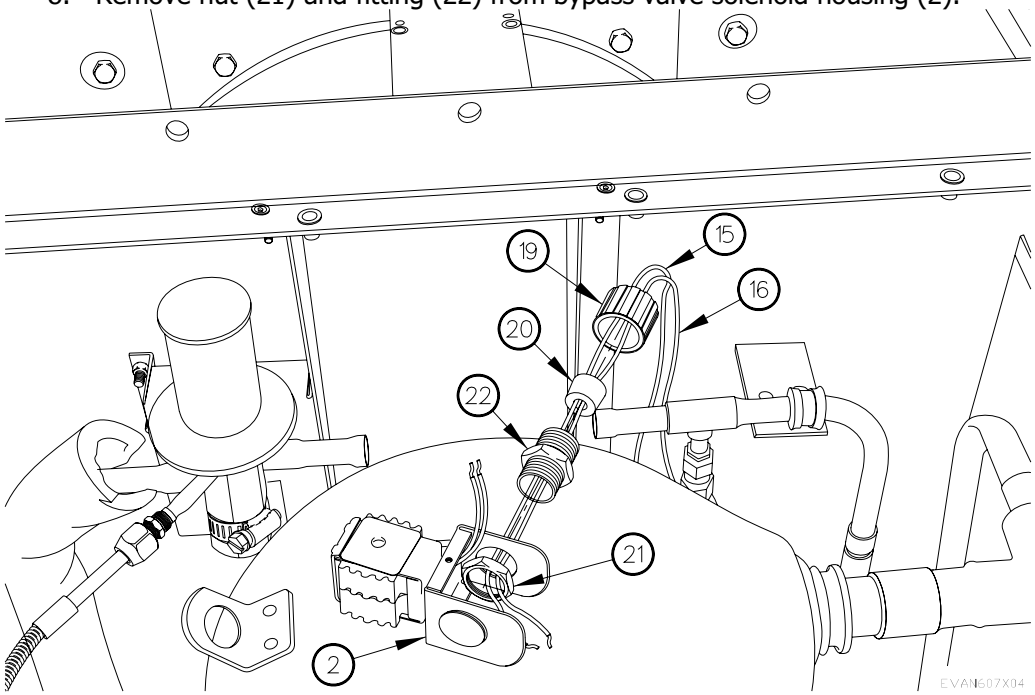
6. Disconnect wires (15 and 16) from wires (17 and 18).



Removal (Continued)

7. Remove fitting (19), grommet (20), and wires (15 and 16) from bypass valve solenoid housing (2).

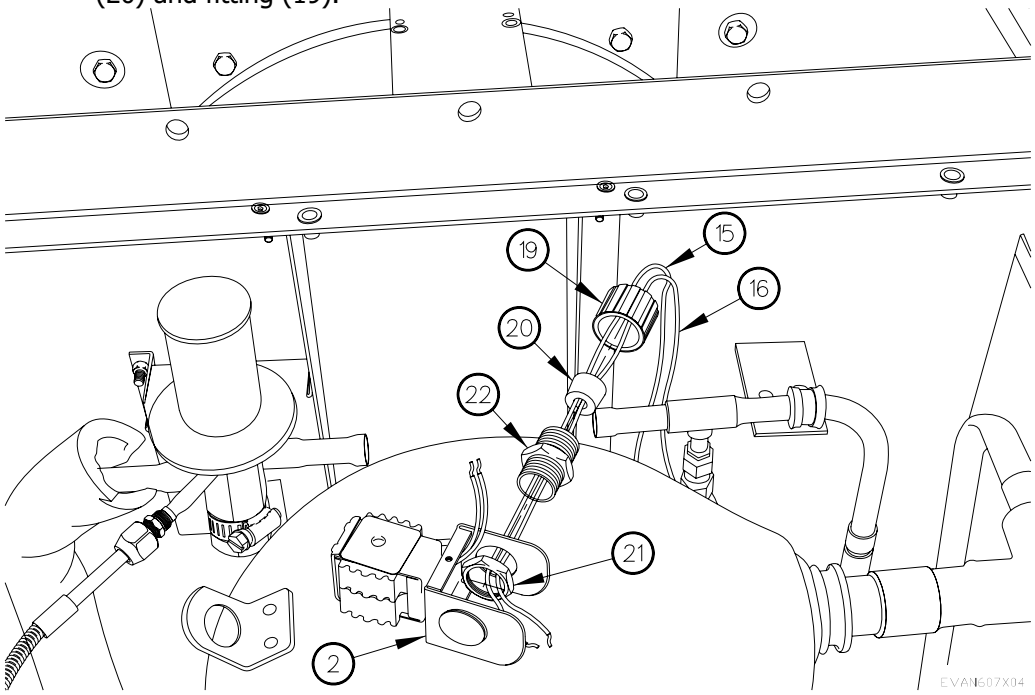
8. Remove nut (21) and fitting (22) from bypass valve solenoid housing (2).



Installation

1. Install fitting (22) in bypass valve solenoid housing (2) with nut (21).

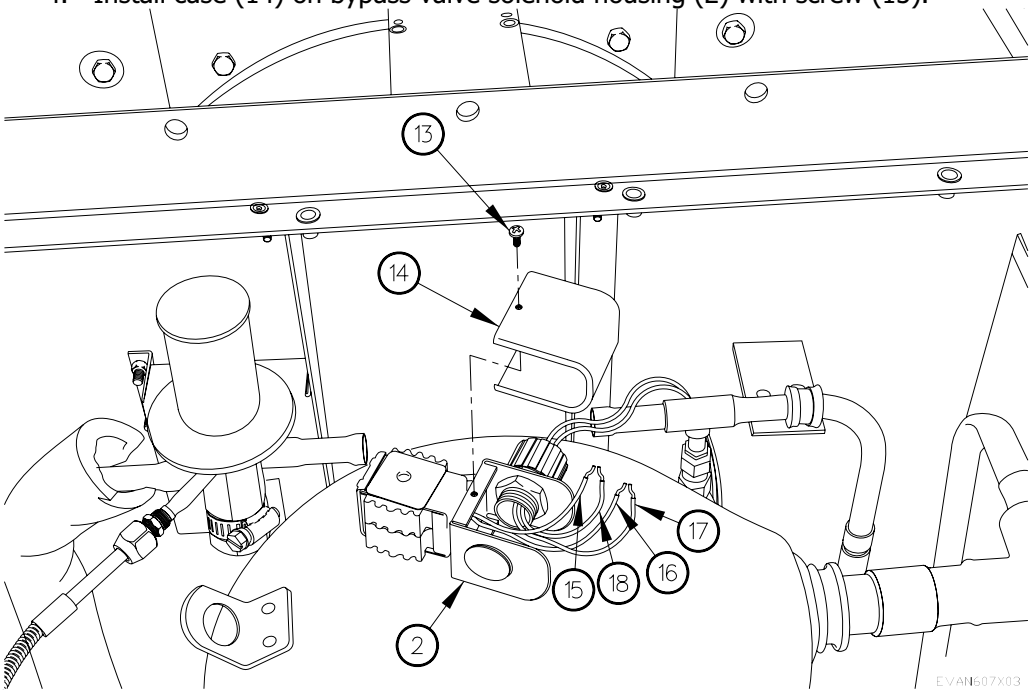
2. Install wires (15 and 16) in bypass valve solenoid housing (2) with grommet (20) and fitting (19).



Installation - Continued

3. Connect wires (15 and 16) to wires (17 and 18).

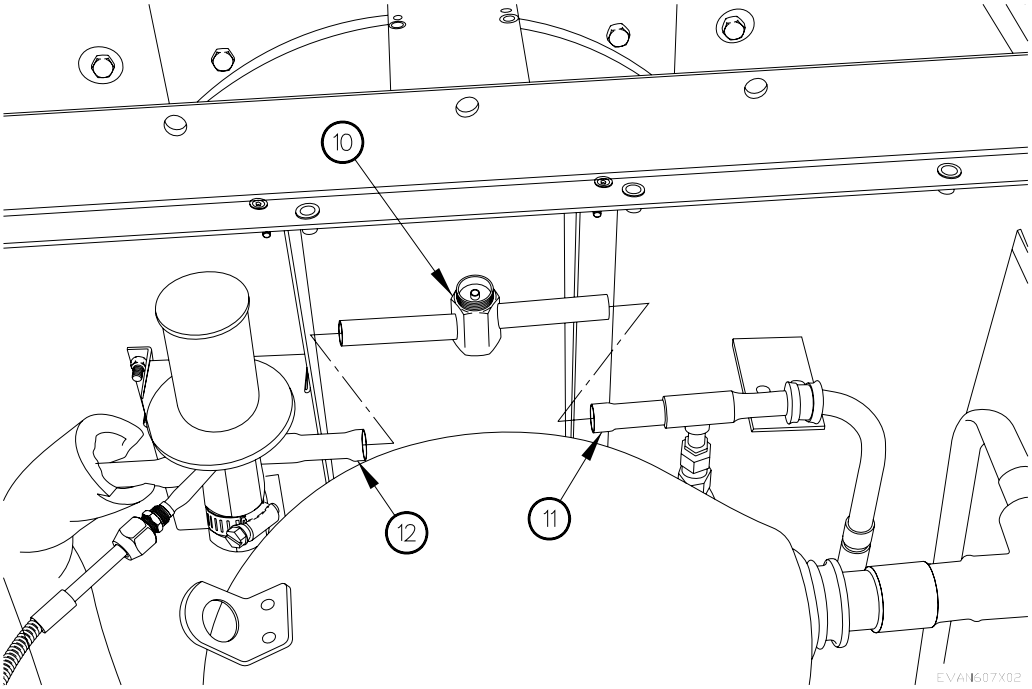
4. Install case (14) on bypass valve solenoid housing (2) with screw (13).



Installation – Continued

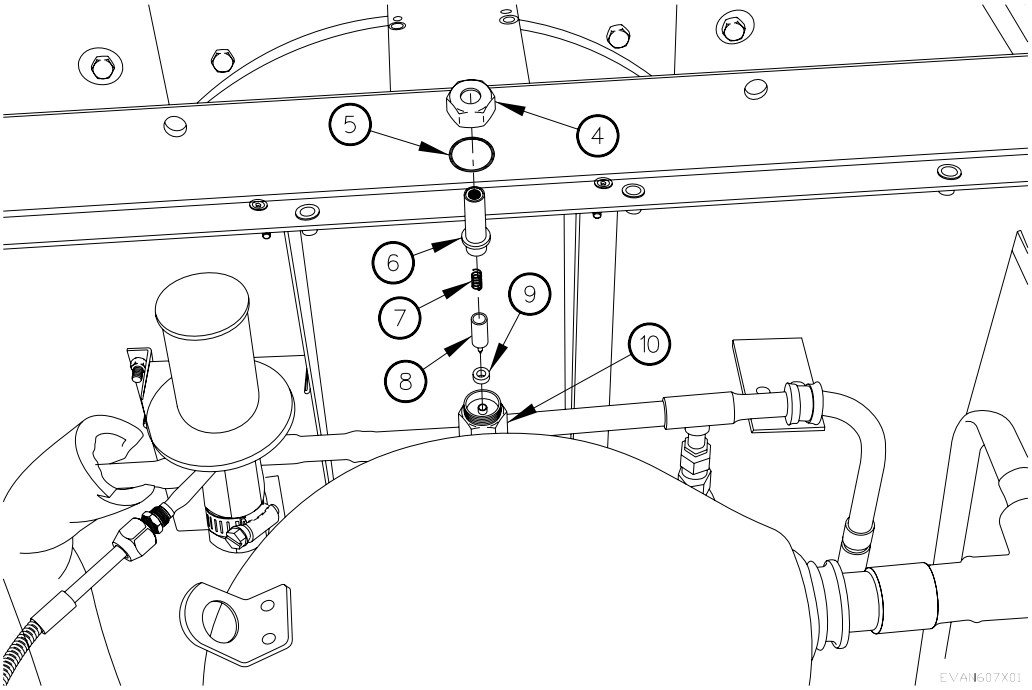
5. Install base (10) on tubing (11 and 12).

6. Brazen tubing (11 and 12) on base (10).



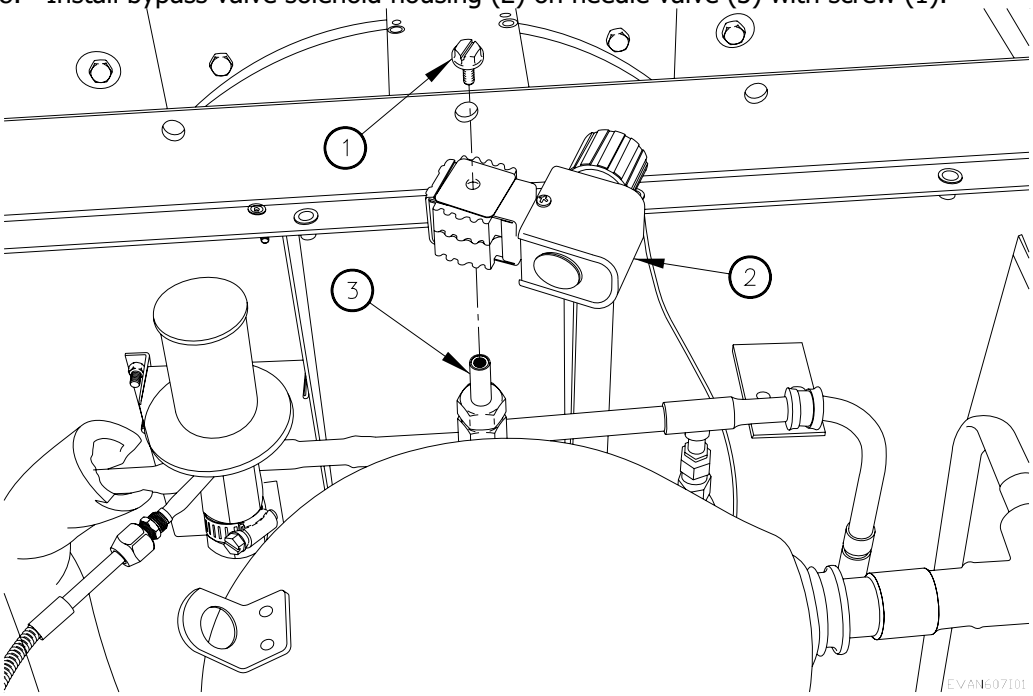
Installation – Continued

7. Install needle seat (9) and needle valve (8) in base (10) with spring (7), housing (6), seal (5) and nut (4).



Installation - Continued

8. Install bypass valve solenoid housing (2) on needle valve (3) with screw (1).



END OF WORK PACKAGE.

EXPANSION VALVE REPLACEMENT 6.8

THIS WORK PACKAGE COVERS:

INITIAL SETUP:

Maintenance Level
Field

Equipment Conditions
Remove A/C unit (para 6.22)
A/C discharged (para 11)

Tools and Special Tools
Genl Mech Tool Kit (NSN 5180-01-454-3787)

Expendable/Durable
Cork Tape (5640-00-906-0936)

Follow-On Mainenance
Replace air dryer (para 6.5)
Charge A/C (para 11)
Bench Test Unit (para 6.25)
Check for leaks (para 6.27)
Install A/C unit (par 6.22)

Parts Figure
Figure 230-00018-AP

Removal

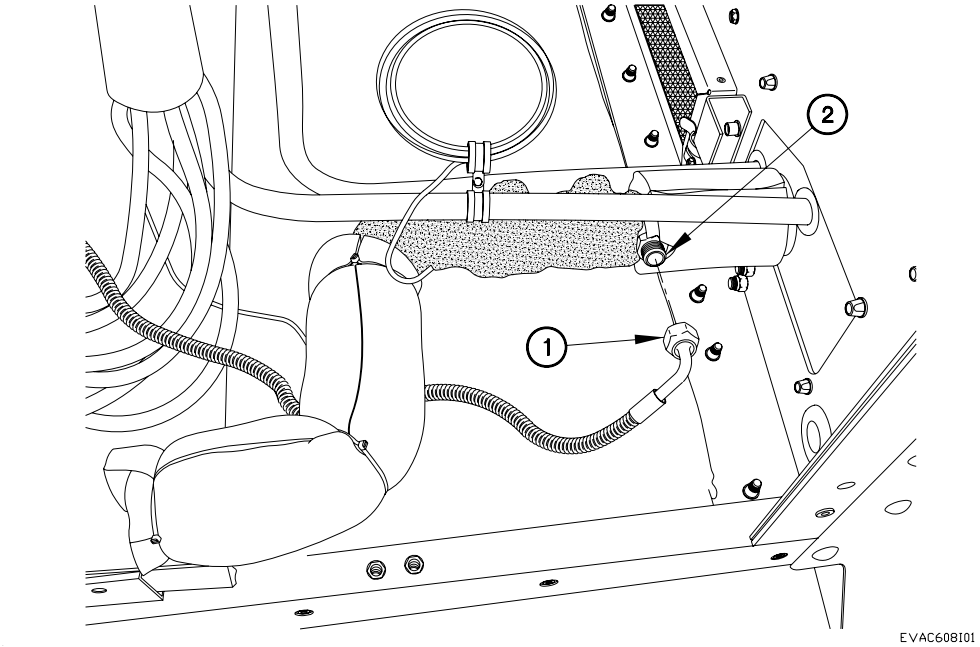
WARNING

Use caution when heating copper tubing or working with a torch. Ensure area around copper tubing is clear or protected prior to heating. Failure to comply may result in serious injury to personnel or damage to equipment.

Expansion valve is filled with mercury. In case of a leak, use extreme caution when handling. Failure to comply may result in serious injury to personnel.

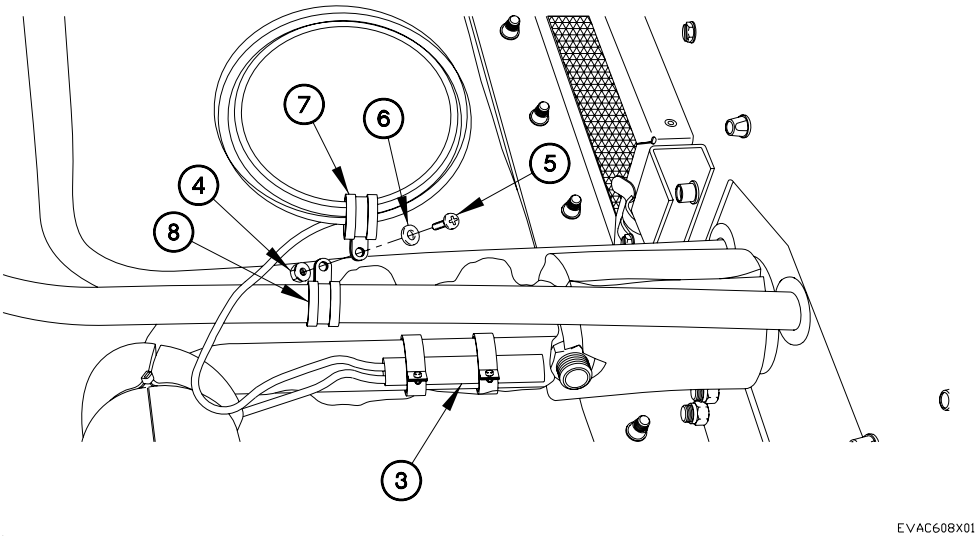
Removal (Continued)

1. Disconnect fitting (1) from connector (2).



2. Remove insulation tape from tubing (3).

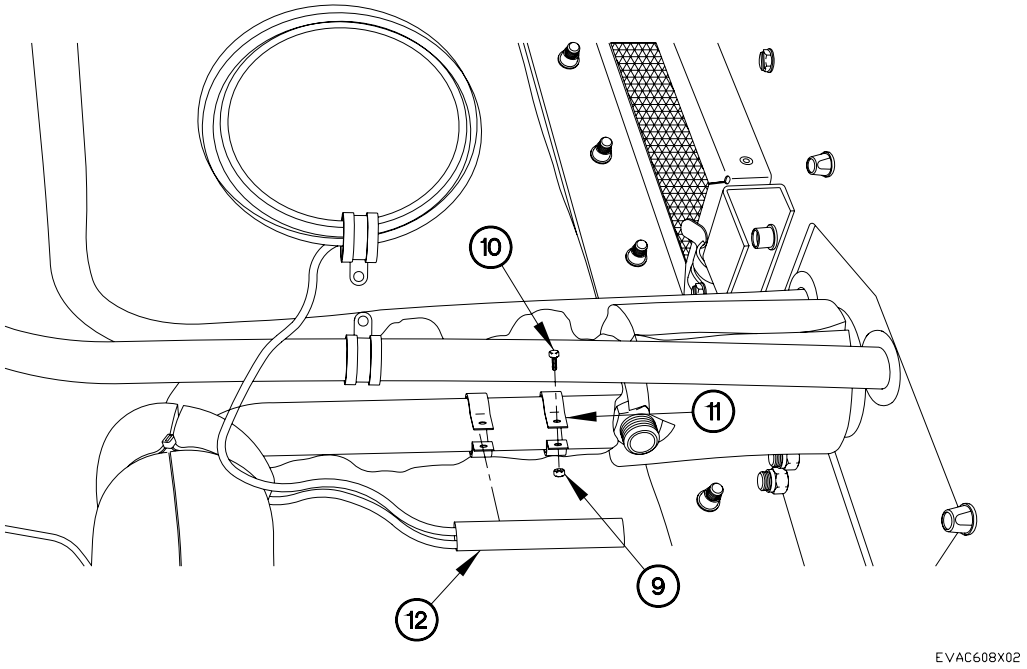
3. Remove self-locking nut (4), screw (5), washer (6), and clamp (7) from clamp (8).



Removal (Continued)

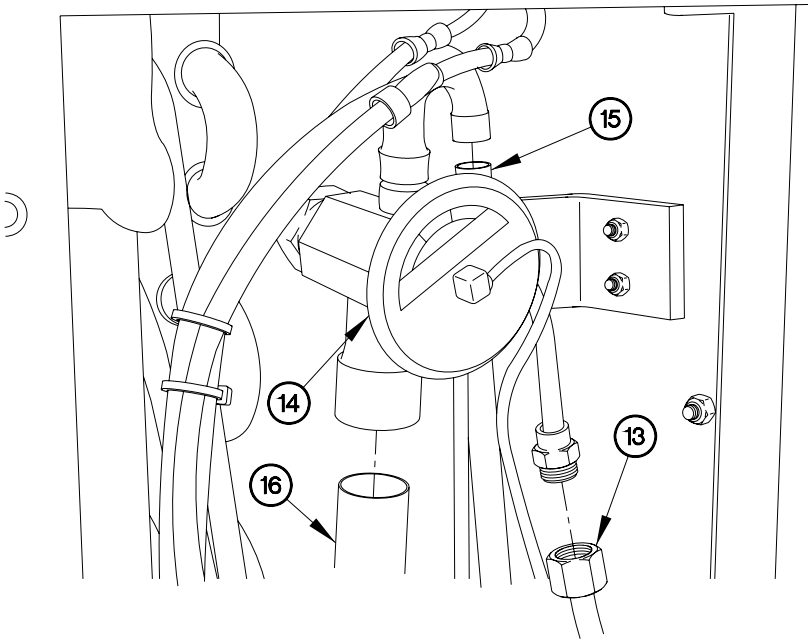
4. Remove two nuts (9) and screws (10) from clamps (11).

5. Remove thermocouple (12) from two clamps (11).



Removal (Continued)

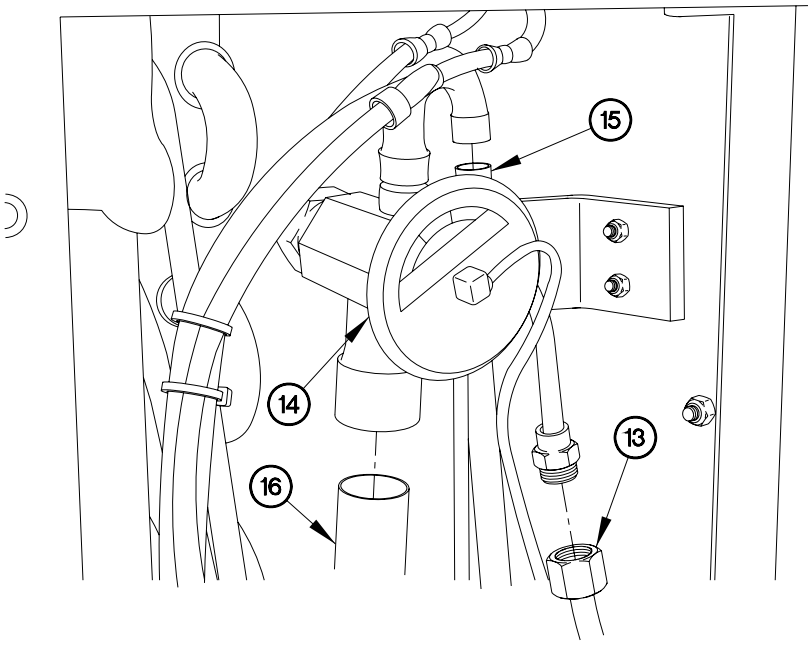
6. Disconnect fitting (13) from expansion valve (14).
7. Heat tubing (15 and 16).
8. Remove expansion valve (14) from tubing (15 and 16).



EVAC608X03

Installation

1. Install expansion valve (14) in tubing (15 and 16).
2. Brazen tubing (15 and 16).
3. Connect fitting (13) to expansion valve (14).



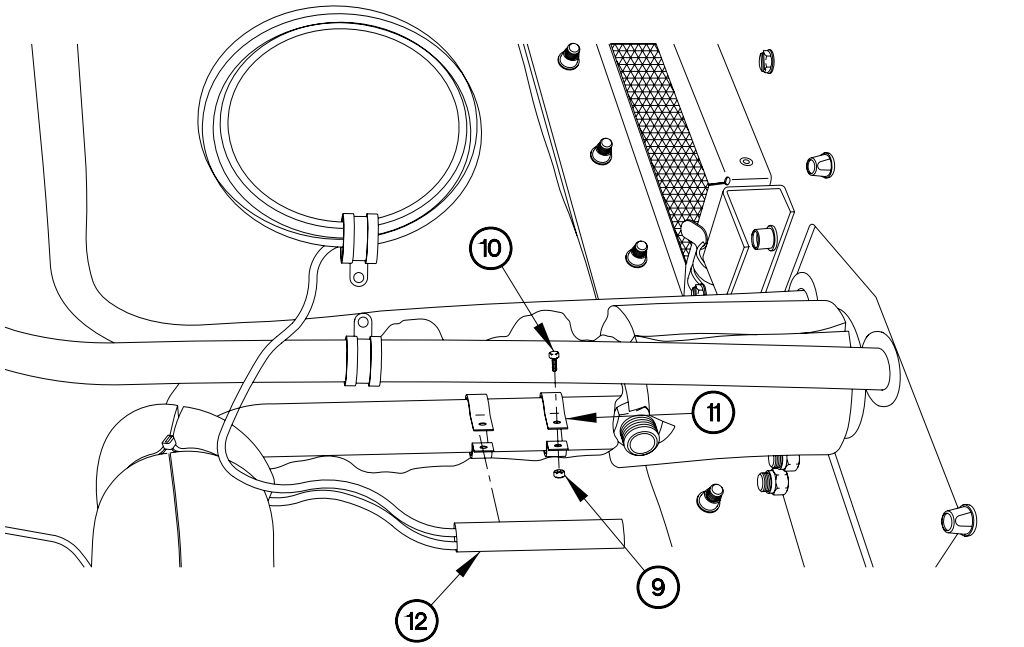
EVAC608X03

Installation - Continued

NOTE

Replace insulation tape as required.

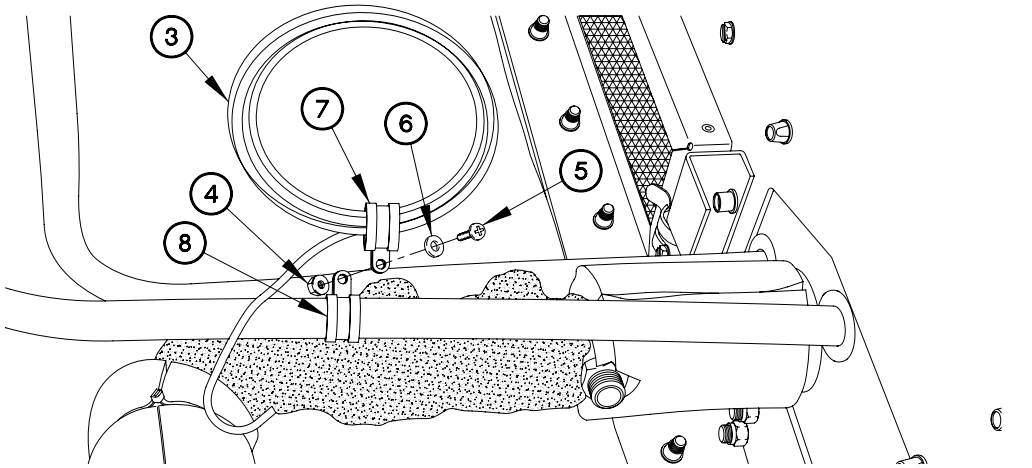
4. Install thermocouple (12) in two clamps (11) with screws (10) and nuts (9).



Installation - Continued

5. Install clamp (8) on clamp (7) with washer (6), screw (5), and self-locking nut (4).

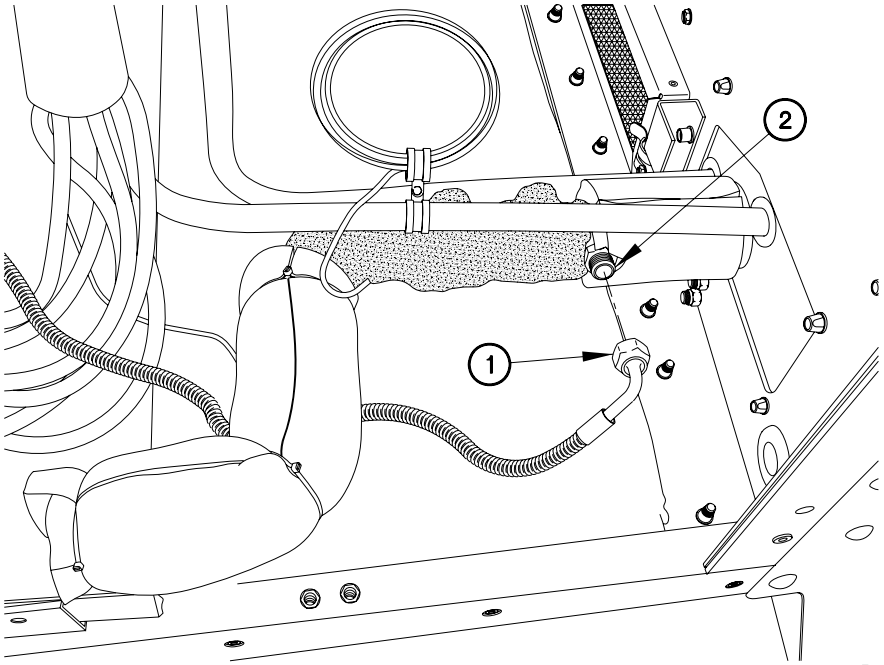
6. Install insulation tape on tubing (3).



EVAC608X01

Installation - Continued

7. Connect fitting (1) to connector (2).



END OF WORK PACKAGE.

COMPRESSOR REPLACEMENT 6.9

THIS WORK PACKAGE COVERS:

INITIAL SETUP:

Maintenance Level
Field

Equipment Conditions
Air Dryer Removed (para 6.5)

Personnel Required
(2)

Tools and Special Tools
Genl Mech Tool Kit (NSN 5180-01-454-3787)

Tools and Special Tools (Cont)
Chain with lifting hook

Follow-On Mainenance
Install Air Dryer (para 6.5)
Charge A/C (para 11)
Bench test unit (para 6.25)
Check for leaks (para 6.26)

Parts Figure
Figure 230-00018-A20

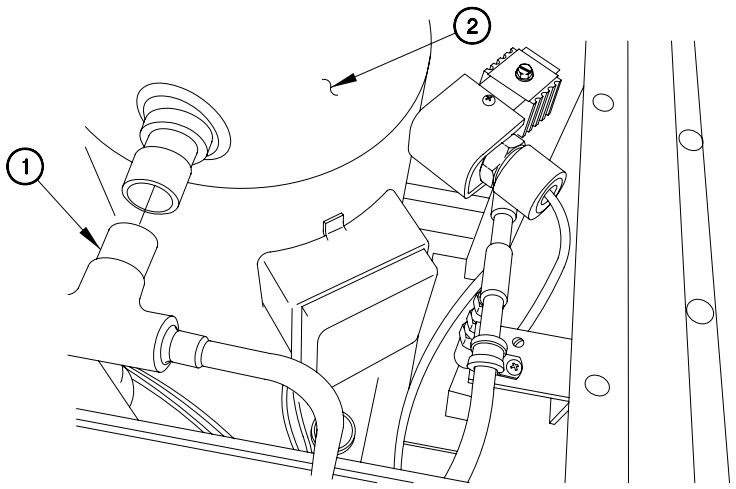
Removal

WARNING

Use caution when heating copper tubing or working with a torch. Ensure area around copper tubing is clear or protected prior to heating. Failure to comply may result in serious injury to personnel or damage to equipment.

1. Heat tubing (1) on compressor (2).

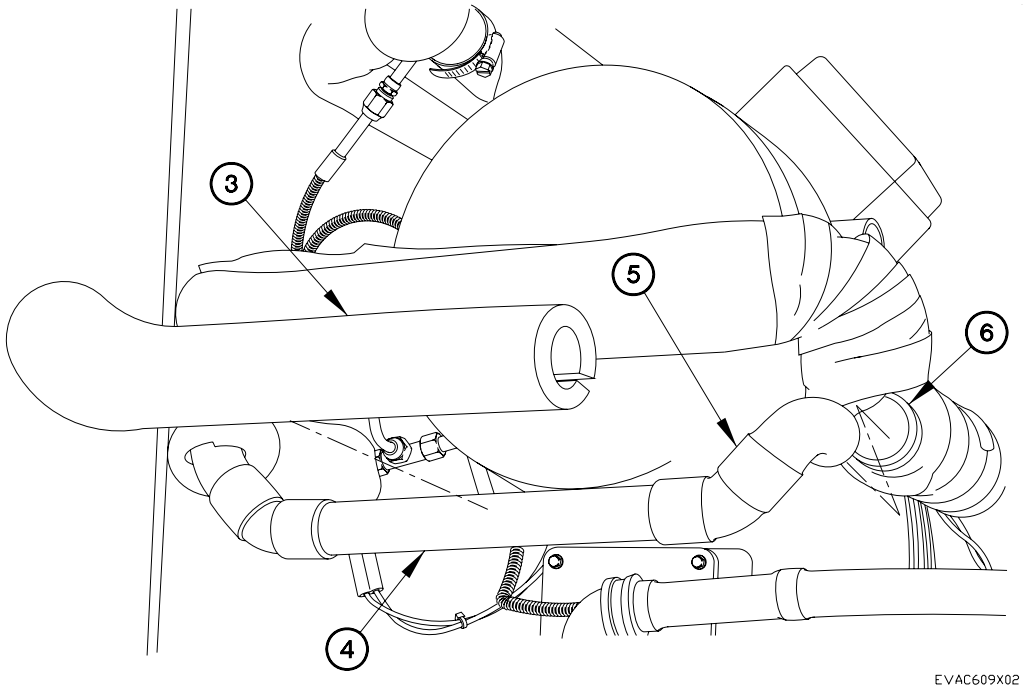
2. Remove tubing (1) from compressor (2).



EVAC609X01

Removal - Continued

3. Remove insulation (3) from tubing (4).
4. Heat 45 degree fitting (5) on flex tubing (6)
5. Remove 45 degree fitting (5) from flex tubing (6).



Removal - Continued

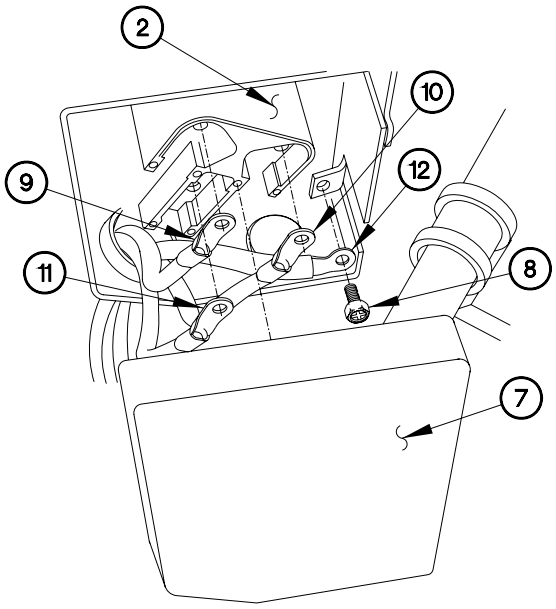
NOTE

Note location of terminal lugs prior to removal.

Tag terminal lugs and connection points prior to removal.

6. Remove terminal box cover (7) from compressor (2).

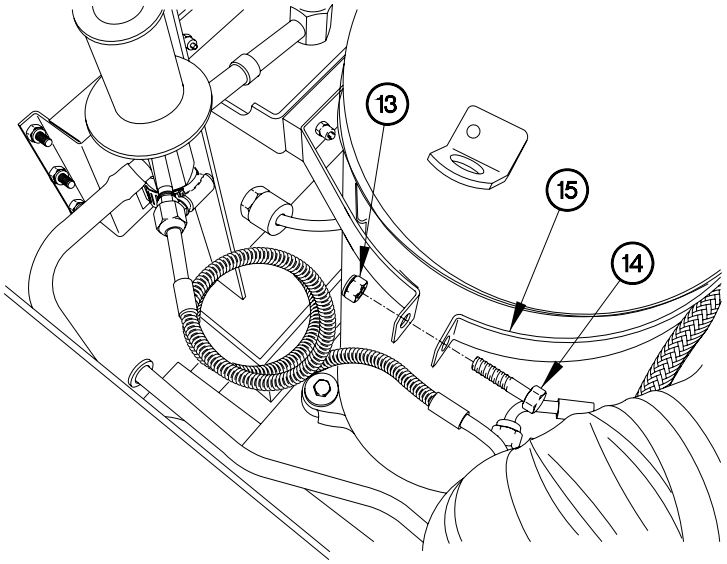
7. Remove four screws (8), and terminal lugs 13 (black) (9), 14 (white) (10), 15 (red) (11), and ground (green) (12) from compressor (2).



EVAC609X03

Removal - Continued

8. Remove self-locking nut (13) and bolt (14) from clamp (15). Discard self-locking nut.



EVAC609X04

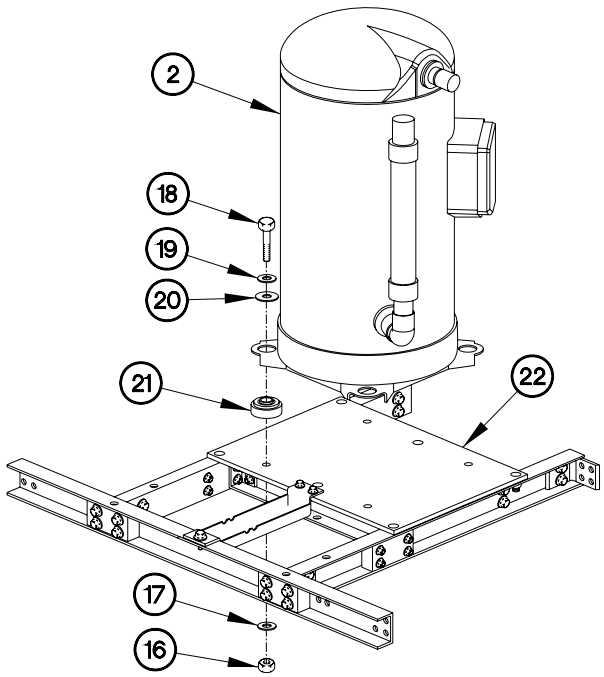
Removal - Continued

9. Remove four nuts (16), lockwashers (17), bolts (18), and washers (19 and 20) from compressor (2).

WARNING

Compressor weighs approximately 125 lbs (57 kgs). Attach a suitable lifting device prior to removal. Failure to comply may result in serious injury to personnel or damage to equipment.

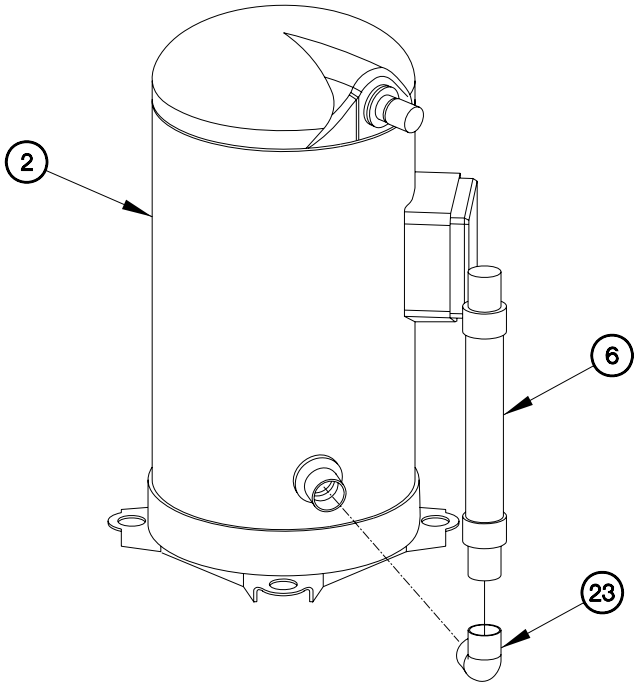
10. Remove compressor (2) and four spacers (21) from A/C body (22).



EVAC609X05

Removal - Continued

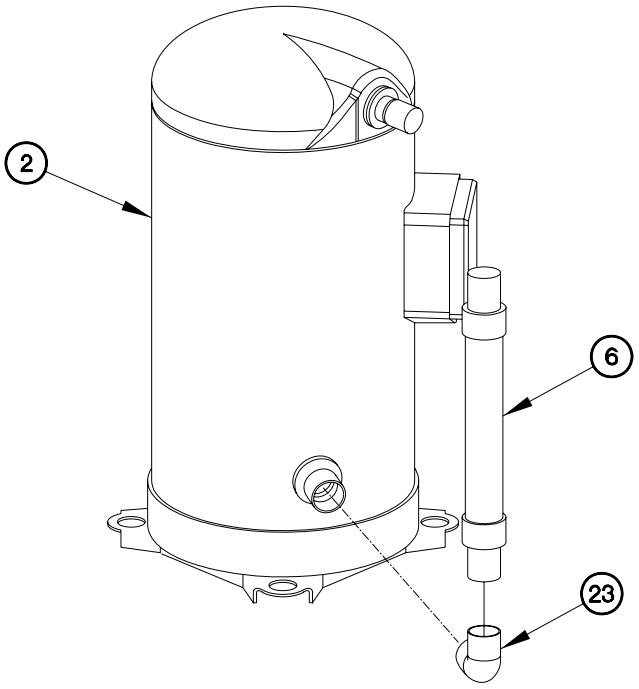
11. Heat flex tubing (6).
12. Remove flex tubing (6) from 45-degree tubing (23).
13. Heat 45-degree tubing (23).
14. Remove 45-degree tubing (23) from compressor (2).



EVAC609X06

Installation

1. Install 45-degree tubing (23) on compressor (2).
2. Brazen 45-degree tubing (23).
3. Install flex tubing (6) on 45-degree tubing (23).
4. Brazen flex tubing (6).



EVAC609X06

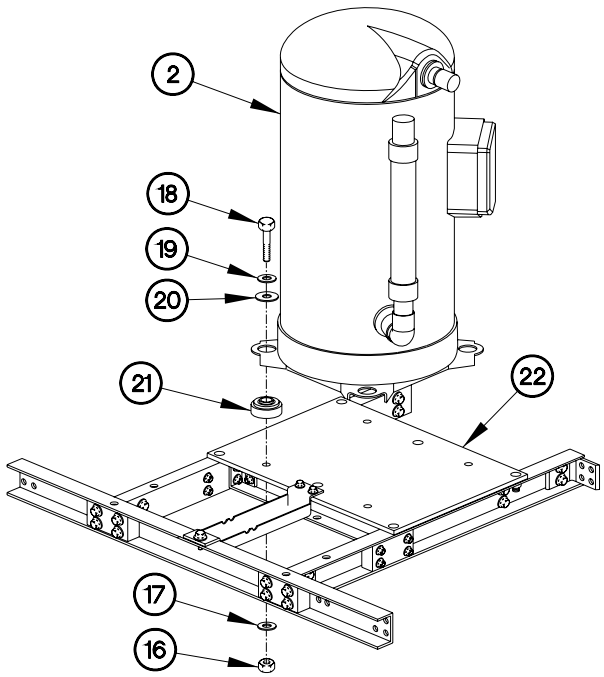
Installation - Continued

WARNING

Compressor weighs approximately 125 lbs (57 kgs). Attach a suitable lifting device prior to installation. Failure to comply may result in serious injury to personnel or damage to equipment.

5. Install four spacers (21) and compressor (2) on A/C body (22).

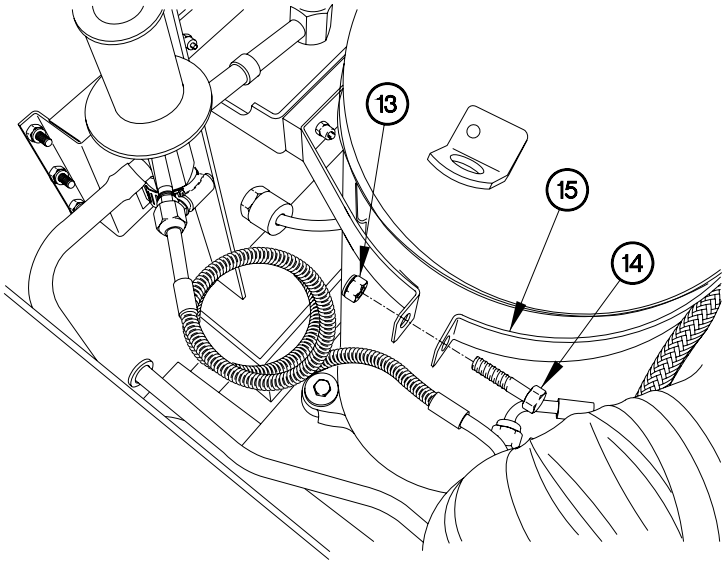
6. Install four washers (19 and 20) and bolts (18) on compressor (2) with four lockwashers (17) and nuts (16).



EVAC609X05

Installation - Continued

7. Install bolt (14) in clamp (15) with self-locking nut (13).



EVAC609X04

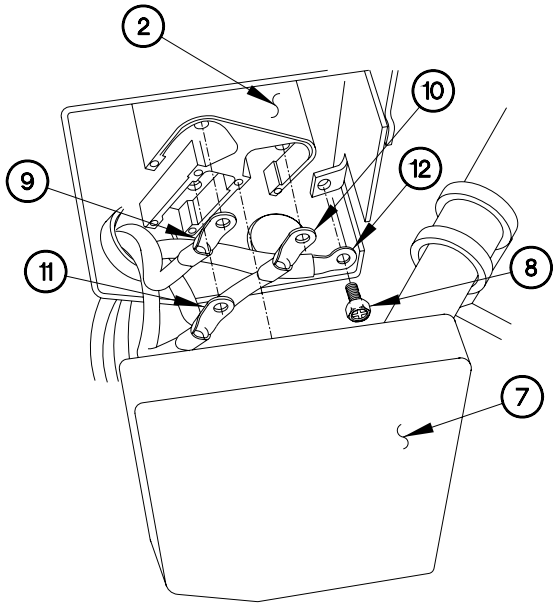
Installation - Continued

NOTE

Use location of terminal lugs noted during removal.

8. Install terminal lugs 13 (black (9), 14 (white (10), 15 (red) (11), and ground (green) (12) on compressor (2) with four screws (8).

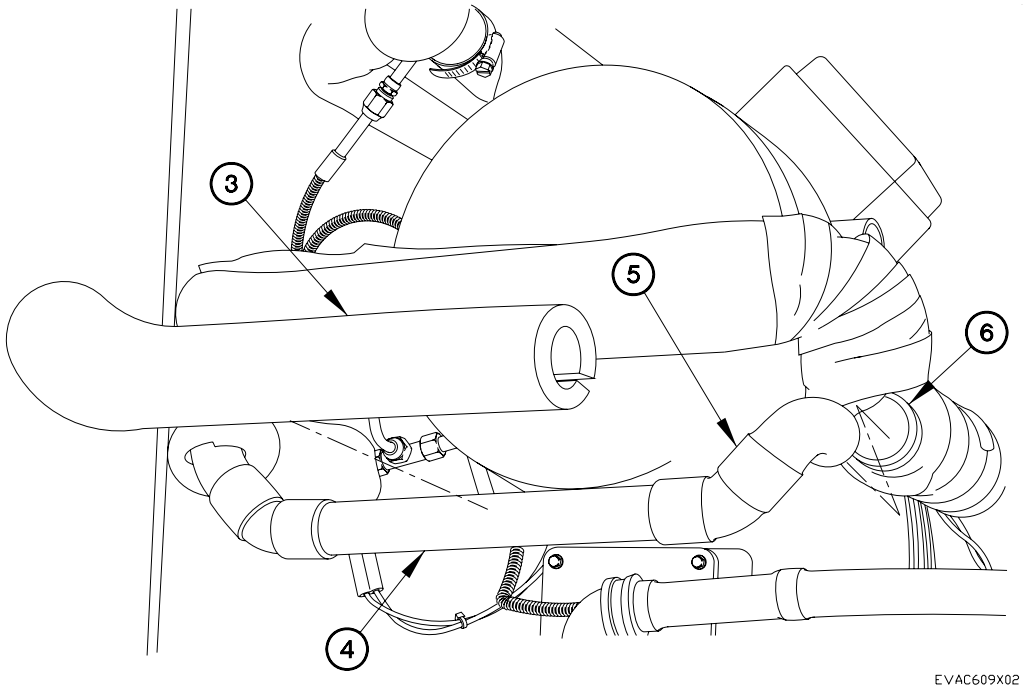
9. Install terminal box cover (7) on compressor (2).



EVAC609X03

Installation - Continued

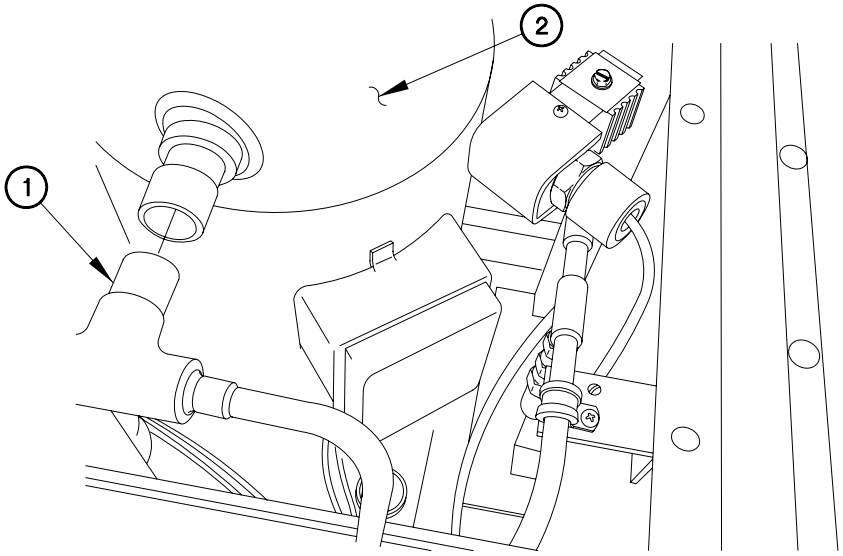
10. Install 45-degree fitting (5) on flex tubing (6).
11. Brazen 45-degree fitting (5).
12. Install insulation (3) on tubing (4).



Installation - Continued

13. Install tubing (1) on compressor (2).

14. Brazen tubing (1) on compressor (2).



EVAC609X01

END OF WORK PACKAGE.

LOW PRESSURE SWITCH REPLACEMENT 6.10

THIS WORK PACKAGE COVERS:

INITIAL SETUP:

Maintenance Level
Field

Equipment Conditions
Engine shut down (392-10)
Generator disconnected
Sides expanded/platform installed (392-10)
Panel(s) removed (para 6.24)

Tools and Special Tools
Genl Mech Tool Kit (NSN 5180-01-454-3787)

Tools and Special Tools (Cont)
Tool Kit, Electrical (NSN 5180-00-876-9336)

Follow-On Mainenance
Connect generator
Install panel(s) (para 6.24)
Operate A/C, checking for proper operation (Chapter 5).
Stow platform/compress sides (392-10)

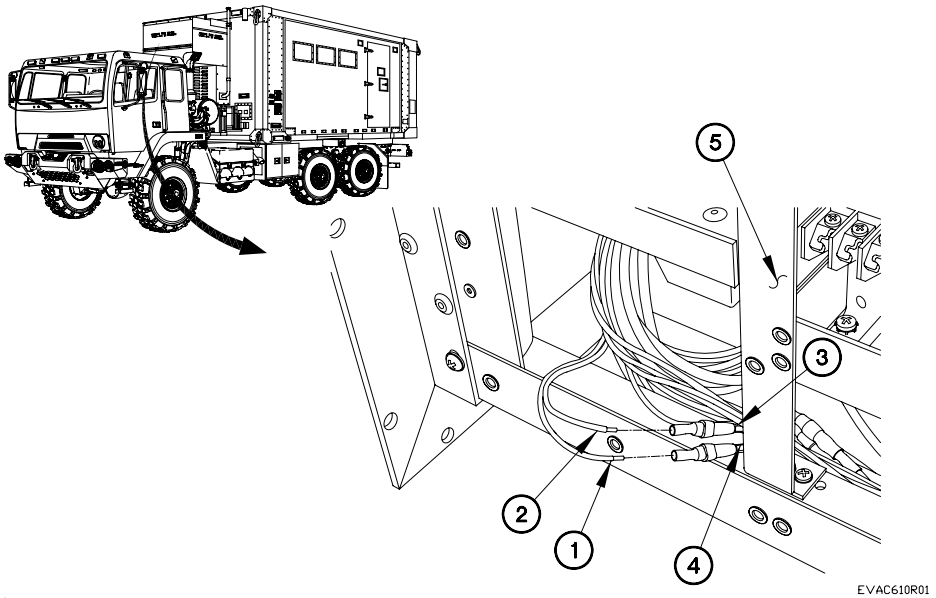
Parts Figure
Figure 230-00018-AP

Removal

NOTE

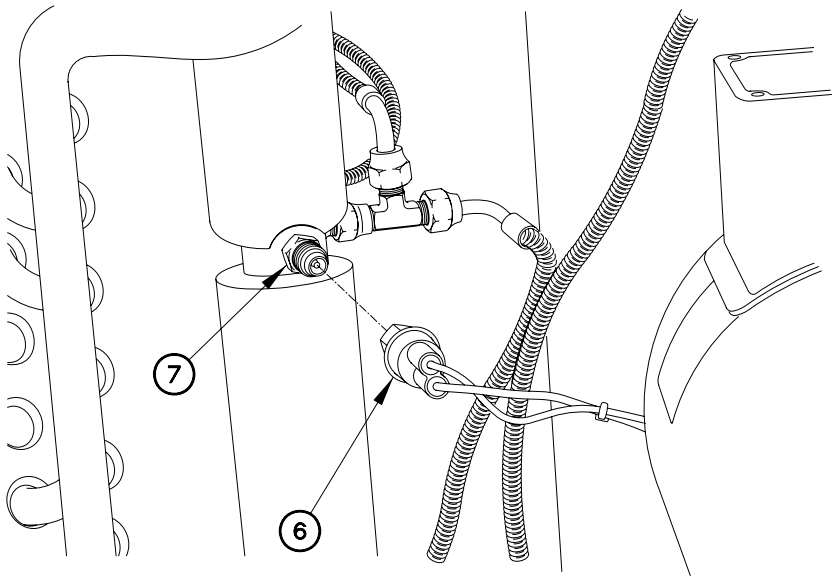
Tag electrical connections and connection points prior to disconnection.

1. Disconnect wires 213 and 215 (1 and 2) and wires (3 and 4).
2. Remove wires 213 and 215 (1 and 2) from A/C body (5).



Removal - Continued

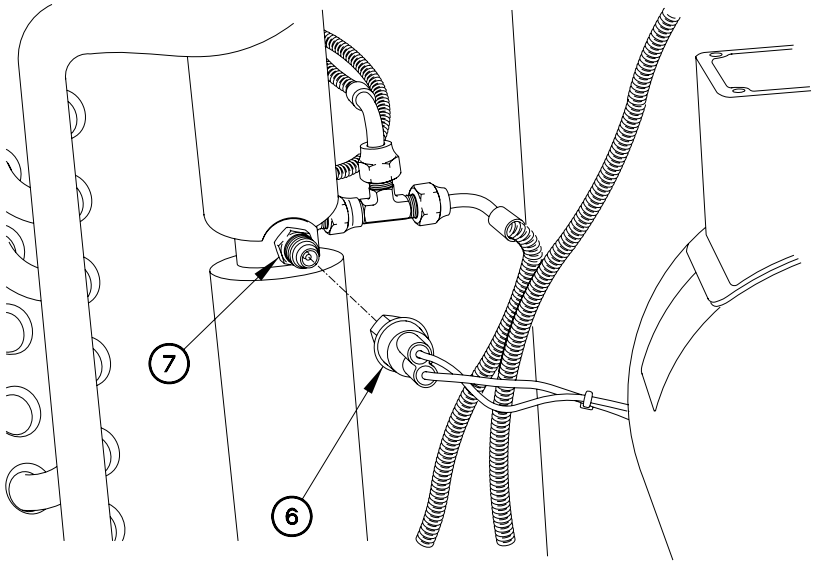
3. Remove low pressure switch (6) from fitting (7).



EVAC610X02

Installation

1. Install low pressure switch (6) to fitting (7).

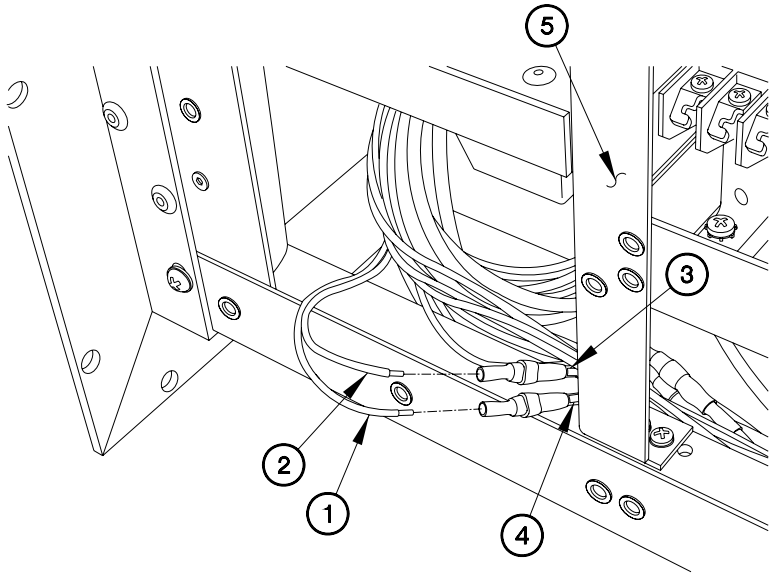


EVAC610X02

Installation - Continued

2. Route wires 213 and 215 (1 and 2) in A/C body (5).

3. Connect wires 213 and 215 (1 and 2) to wires (3 and 4).



EVAC610101

END OF WORK PACKAGE.

HIGH PRESSURE SWITCH REPLACEMENT 6.11

THIS WORK PACKAGE COVERS:

INITIAL SETUP:

Maintenance Level
Field

Equipment Conditions
Engine shut down (392/391-10)
Generator disconnected
Sides expanded/platform installed (392-10)
Remove panel(s) (para 6.24)

Tools and Special Tools
Genl Mech Tool Kit (NSN 5180-01-454-3787)

Tools and Special Tools (Cont)
Tool Kit, Electrical (NSN 5180-00-876-9336)

Follow-On Mainenance
Connect generator
Install panel(s) (para 6.24)
Operate A/C, checking for proper operation (Chapter 5).
Stow platform/compress sides (392-10)

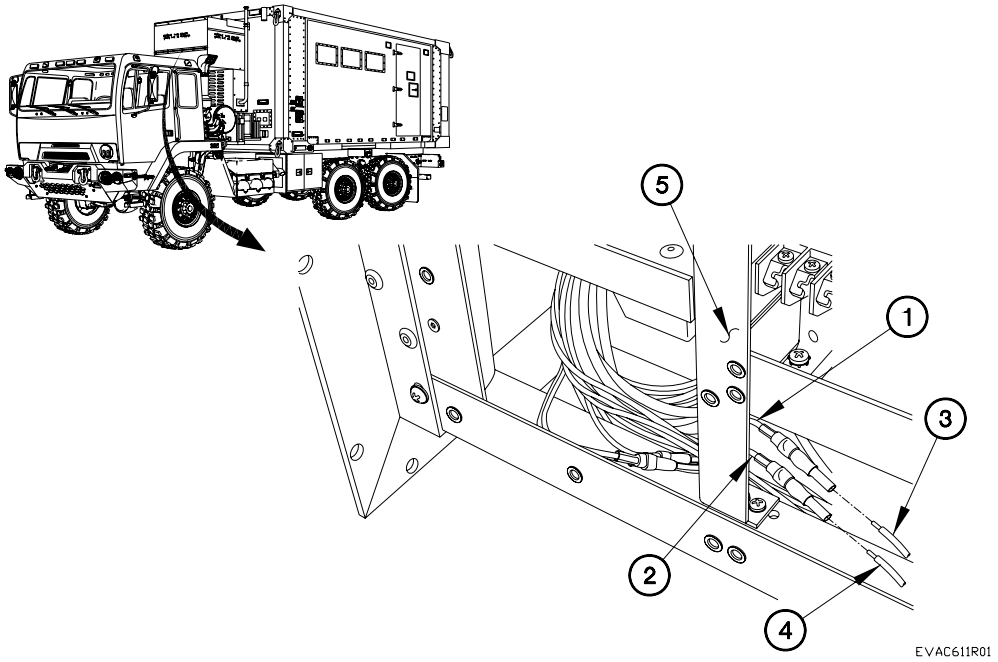
Parts Figure
Figure 230-00018-AP

Removal

NOTE

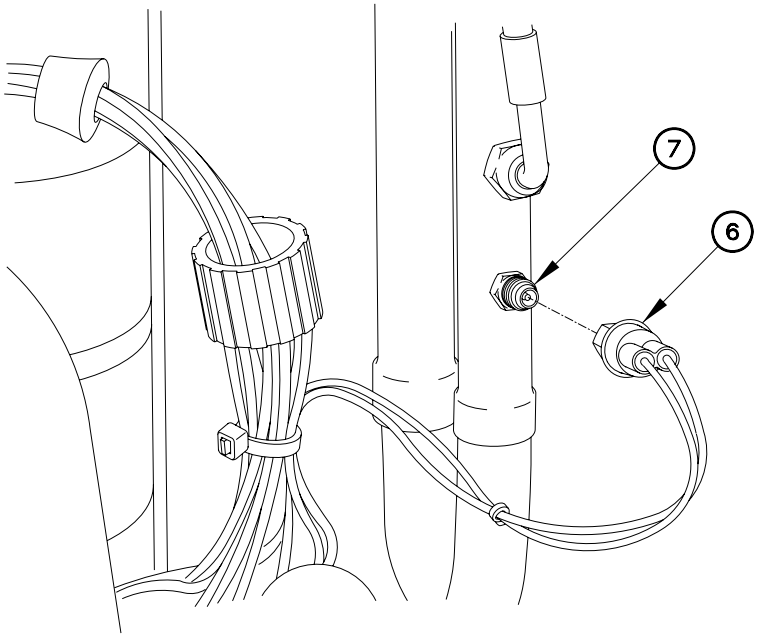
Tag electrical connections and connection points prior to disconnection.

1. Disconnect wires 211 and 213 (1 and 2) from wires (3 and 4).
2. Remove wires 211 and 213 (1 and 2) from A/C body (5).



Removal - Continued

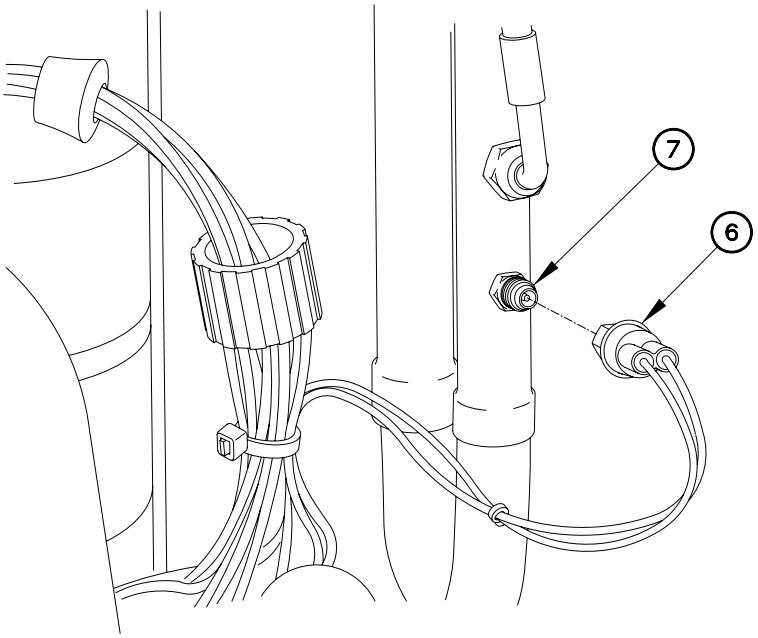
3. Remove high pressure switch (6) from fitting (7).



EVAC611X02

Installation

1. Install high pressure switch (6) on fitting (7).

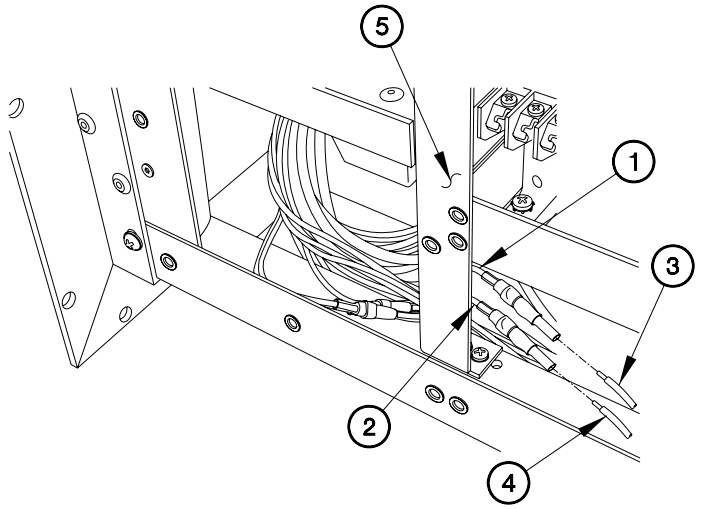


EVAC611X02

Installation - Continued

2. Route wires 211 and 213 (1 and 2) in A/C body (5).

3. Splice wires 211 and 213 (1 and 2) to wires (3 and 4).



EVAC611I01

END OF WORK PACKAGE.

FAN CYCLE SWITCH REPLACEMENT 6.12

THIS WORK PACKAGE COVERS:

INITIAL SETUP:

Maintenance Level
Field

Equipment Conditions
Engine shut down (392/391-10)
Generator disconnected
Sides expanded/platform installed (392-10)
Panel(s) removed (para 6.24)
CB2 removed (para 6.20)

Tools and Special Tools
Genl Mech Tool Kit (NSN 5180-01-454-3787)

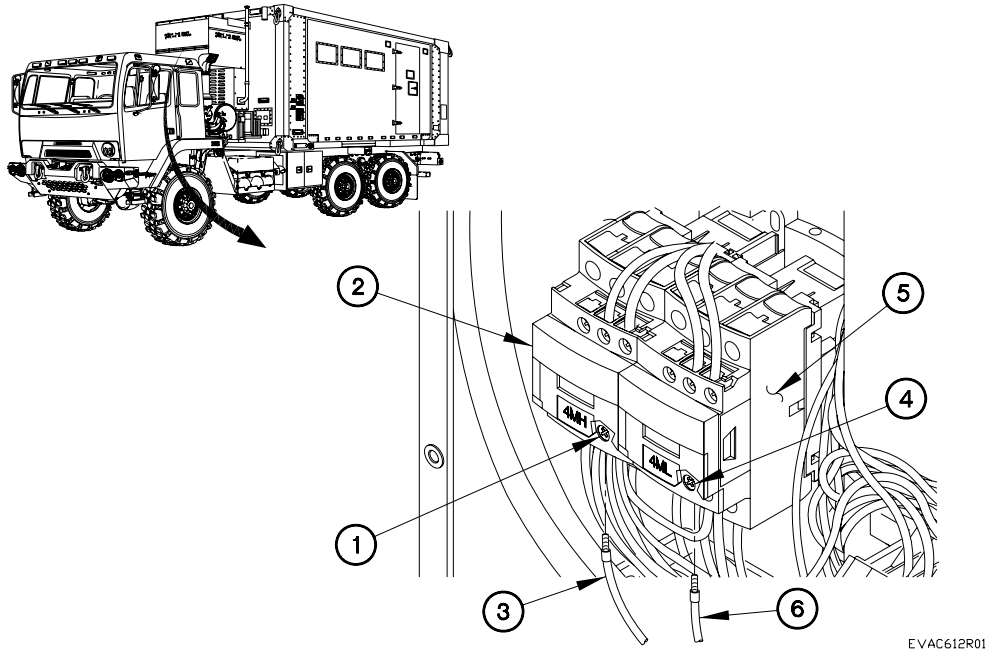
Tools and Special Tools (Cont)
Tool Kit, Electrical (NSN 5180-00-876-9336)

Follow-On Mainenance
Install CB2 (para 6.20)
Install panel(s) (para 6.24)
Connect generator
Operate A/C, checking for proper operation (Chapter 5)
Stow platform/compress sides (392-10)

Parts Figure
Figure 230-00018-AP

Removal

1. Loosen lower middle screw (1) on contactor 4MH (2).
2. Remove black wire 218 (3) from contactor 4MH (2).
3. Loosen lower middle screw (4) on contactor 4ML (5).
4. Remove red wire 216 (6) from contactor 4ML (5).

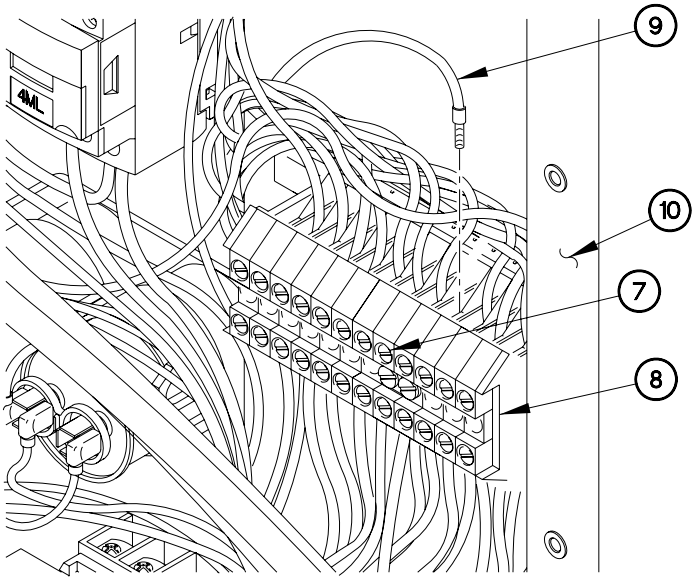


Removal - Continued

NOTE

Wire 215 is located on upper RH terminal board fifth screw from the right.

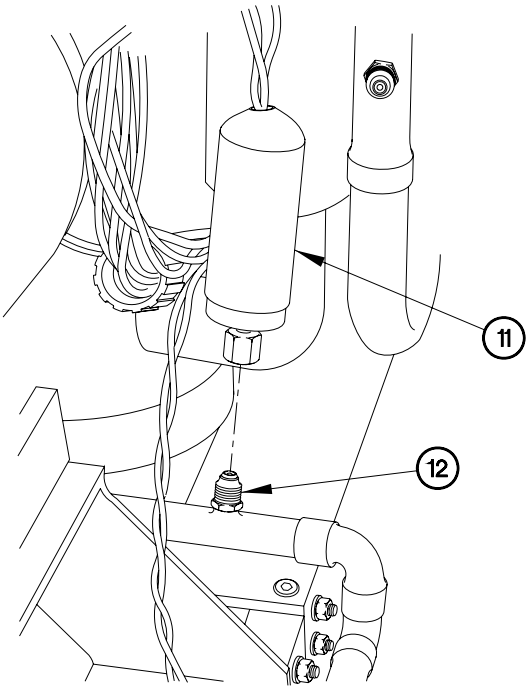
5. Loosen screw 215 (7) on terminal board (8).
6. Remove wire 215 (9) from terminal board (8).
7. Remove wires 215, 216, and 218 from A/C body (10).



EVAC612X02

Removal - Continued

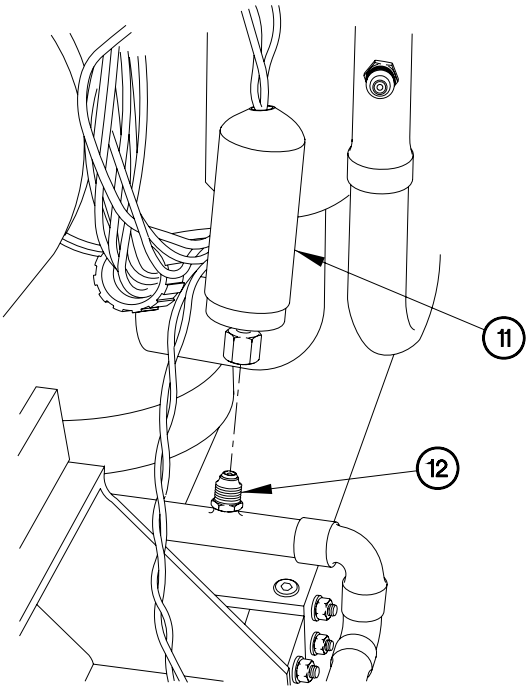
8. Remove fan cycle switch (11) from fitting (12).



EVAC612X03

Installation

1. Install fan cycle switch (11) on fitting (12).



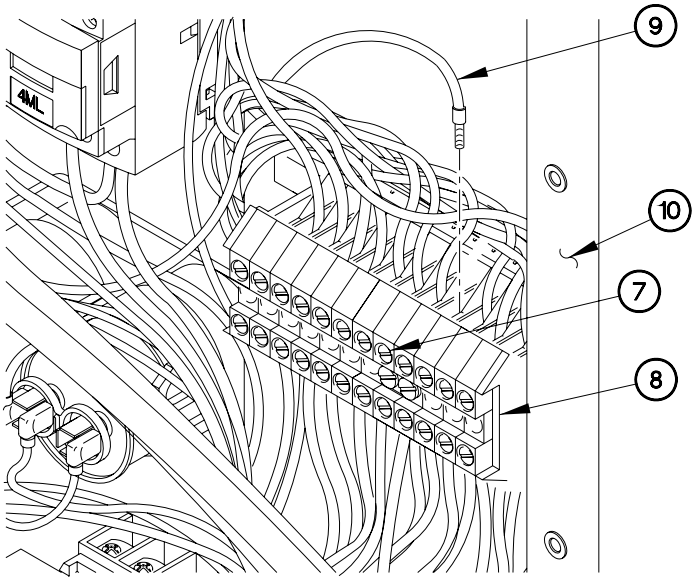
EVAC612X03

Installation - Continued

NOTE

Wire 215 is located on upper RH terminal board fifth screw from the right.

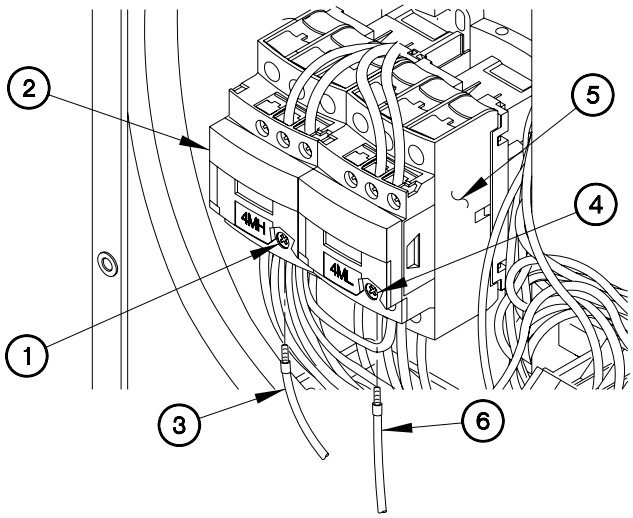
2. Route wires 215, 216, and 218 through A/C body (10).
3. Install wire 215 (9) in terminal board (8).
4. Tighten screw 215 (7) on terminal board (8).



EVAC612X02

Installation - Continued

5. Install red wire 216 (6) in contactor 4ML (5).
6. Tighten lower middle screw (4) on contactor 4ML (5).
7. Install black wire 218 (3) in contactor 4MH (2).
8. Tighten lower middle screw (1) on contactor 4MH (2).



EVAC612I01

END OF WORK PACKAGE.

EVAPORATOR FREEZE THERMOSTAT REPLACEMENT 6.13

THIS WORK PACKAGE COVERS:

INITIAL SETUP:

Maintenance Level
Field

Equipment Conditions
Engine shut down (392/391-10)
Generator disconnected
Sides expanded/platform installed (392-10)
Panel(s) removed (para 6.24)

Tools and Special Tools
Genl Mech Tool Kit (NSN 5180-01-454-3787)

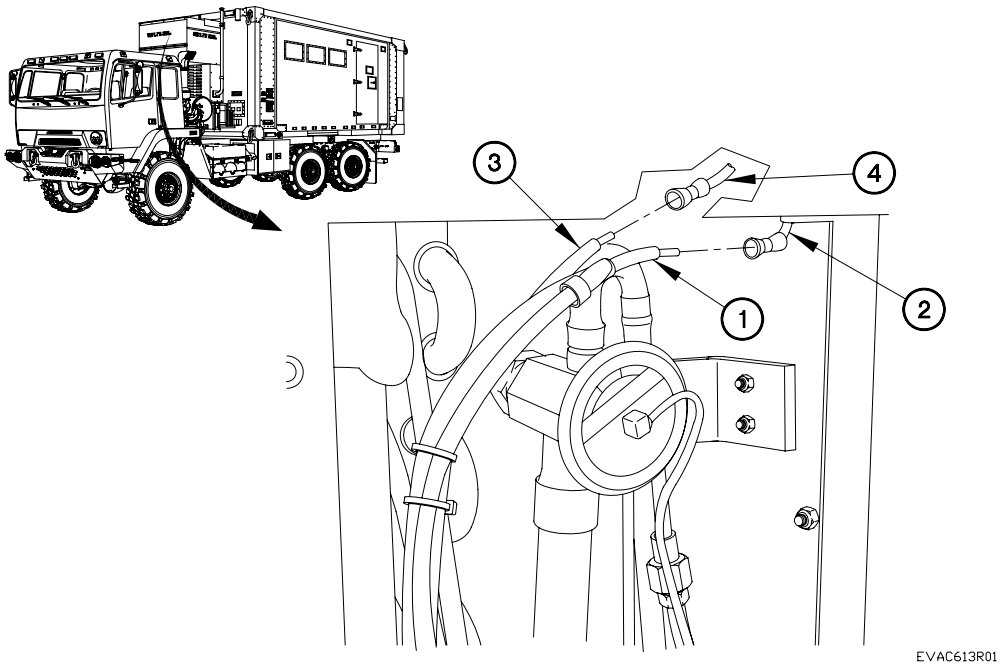
Tools and Special Tools (Cont)
Tool Kit, Electrical (NSN 5180-00-876-9336)

Follow-On Mainenance
Install panel(s) (para 6.24)
Connect generator
Operate A/C, checking for proper operation (Chapter 5)
Stow platform/compress sides (392-10)

Parts Figure
Figure 230-00018-AP

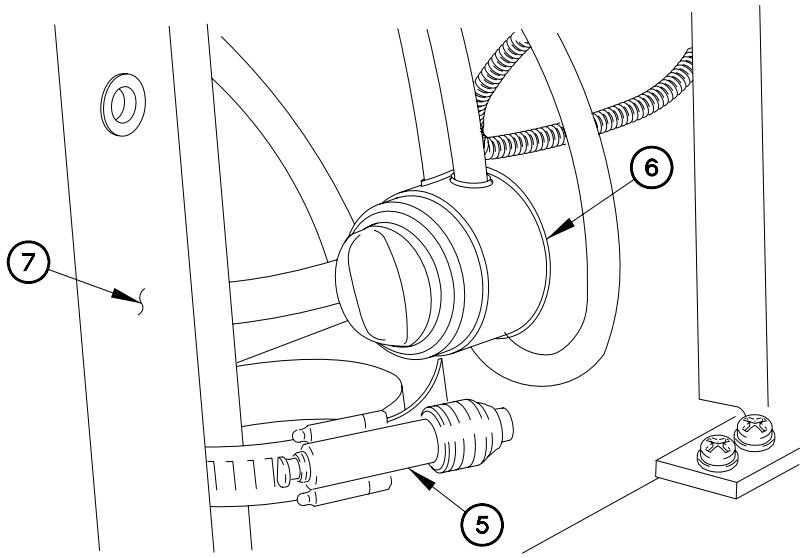
Removal

1. Disconnect wire 19 (1) from 1 (2).
2. Disconnect wire 13 (3) from 3 (4).



Removal - Continued

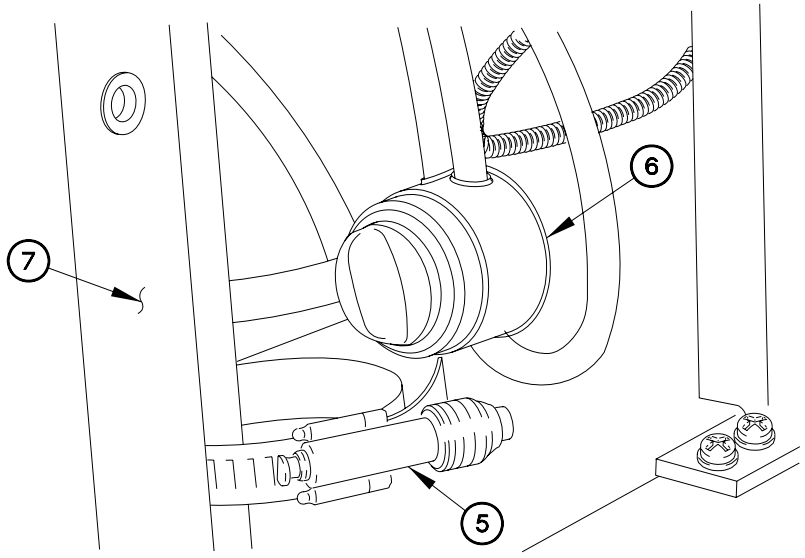
3. Loosen clamp (5) on evaporator freeze thermostat (6).
4. Remove evaporator freeze thermostat (6) from A/C body (7).



EVAC613X02

Installation

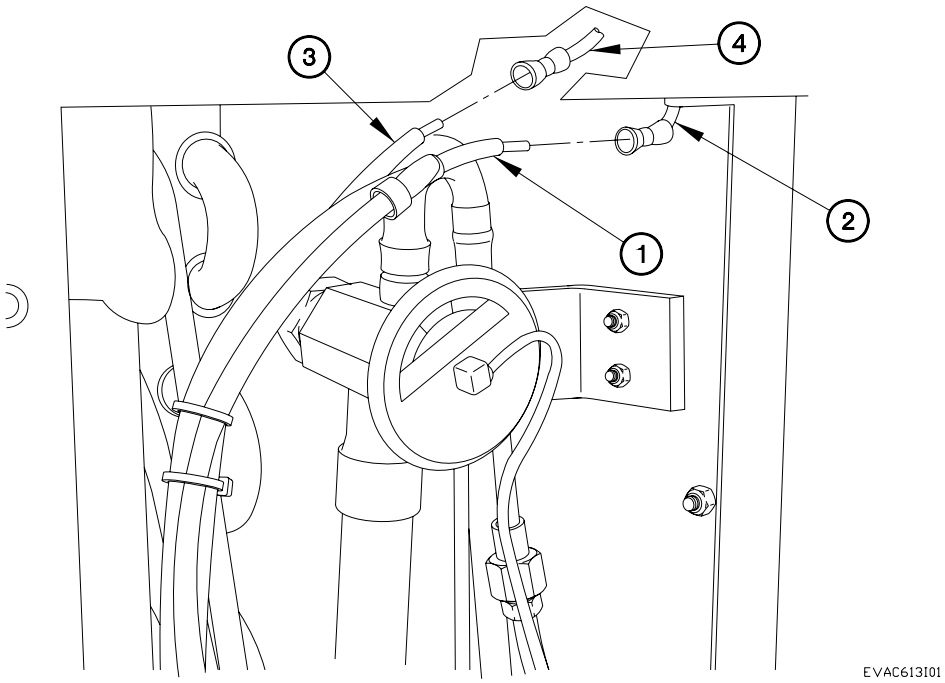
1. Install evaporator freeze thermostat (6) on A/C body (7) with clamp (5).



EVAC613X02

Installation - Continued

2. Connect wires 13 (3) to 3 (4).
3. Connect wires 19 (1) to 1 (2).



END OF WORK PACKAGE.

FAN BLOWER MOTOR REPLACEMENT 6.14

THIS WORK PACKAGE COVERS:

INITIAL SETUP:

Maintenance Level
Field

Equipment Conditions
Heater removed (para 6.15)

Tools and Special Tools
Genl Mech Tool Kit (NSN 5180-01-454-3787)

Tools and Special Tools
Tool Kit, Electrical (NSN 5180-00-876-9336)

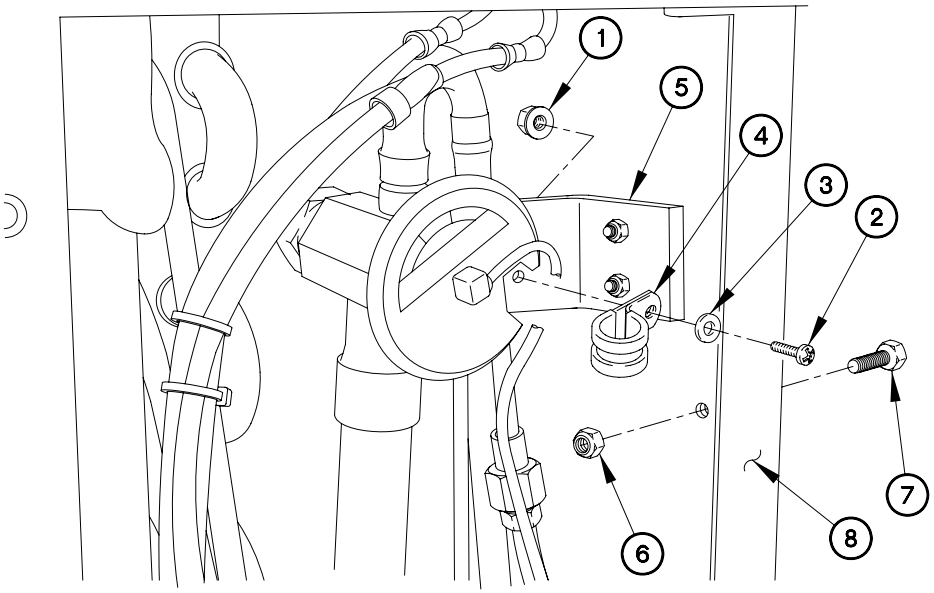
Follow-On Mainenance
Install heater (para 6.15)

Parts Figure
Figure 230-00018-A1

Removal

1. Remove self-locking nut (1), screw (2), washer (3), and clamp (4) from bracket (5).

2. Remove two self-locking nuts (6) and screws (7) from A/C body (8).



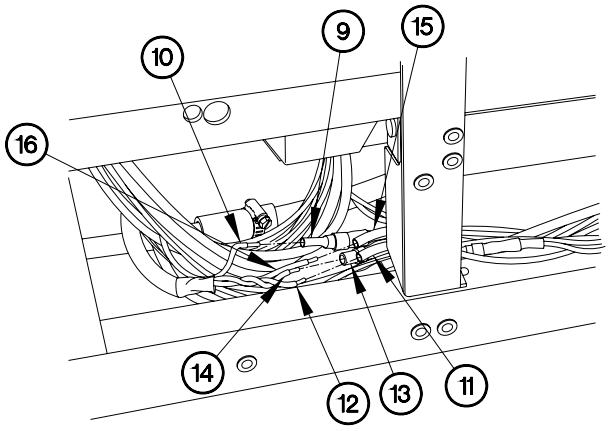
EVAC614X04

Removal - Continued

NOTE

Tag wires and connection points prior to disconnecting.

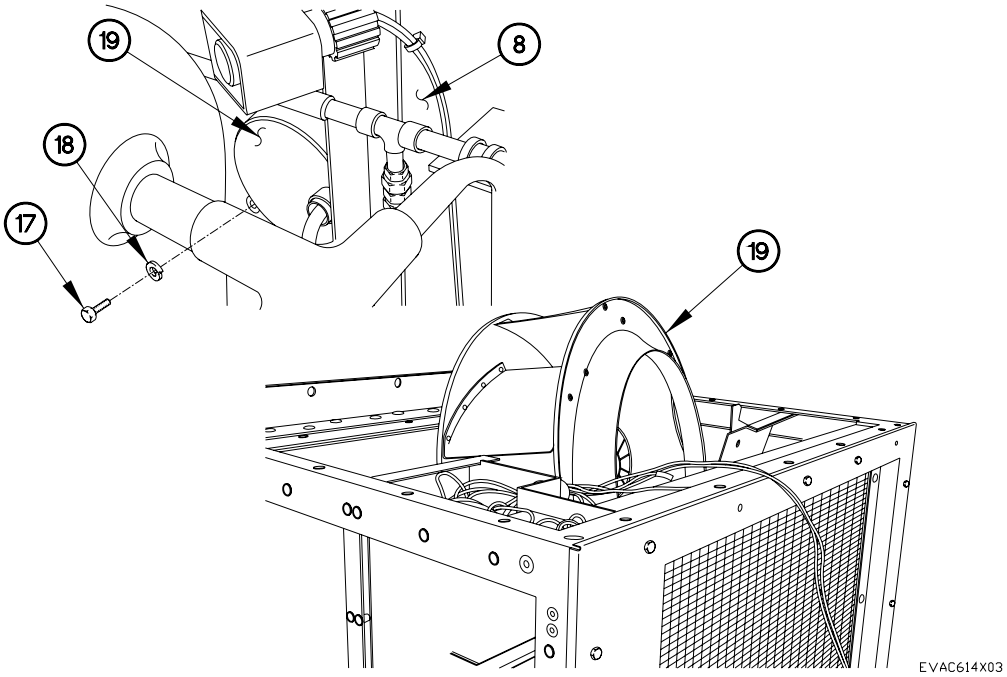
3. Disconnect wire 33 (9) from wire (10).
4. Disconnect wire 34 (11) from wire (12).
5. Disconnect wire 35 (13) from wire (14).
6. Disconnect wire green (ground) (15) from wire (16).



EVAC614X02

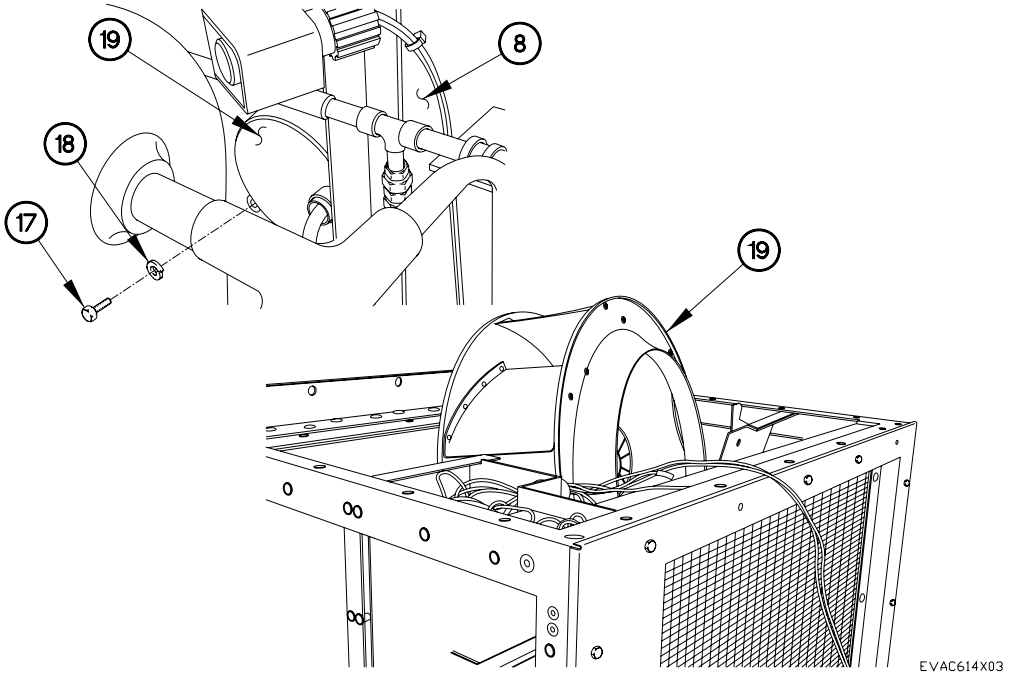
Removal - Continued

7. Remove four bolts (17), lockwashers (18), and fan blower motor (19) from A/C body (8).



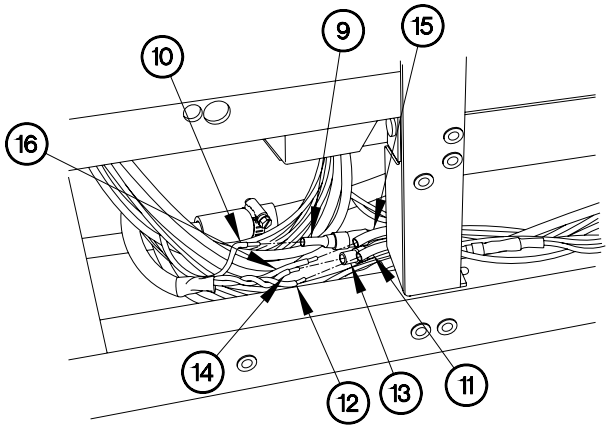
Installation

1. Install fan blower motor (19) on A/C body (8) with four lockwashers (18) and bolts (17).



Installation - Continued

2. Connect green (ground) (15) to wire (16).
3. Connect 35 (13) to wire (14).
4. Connect 34 (11) to wire (12).
5. Connect 33 (9) to wire (10).

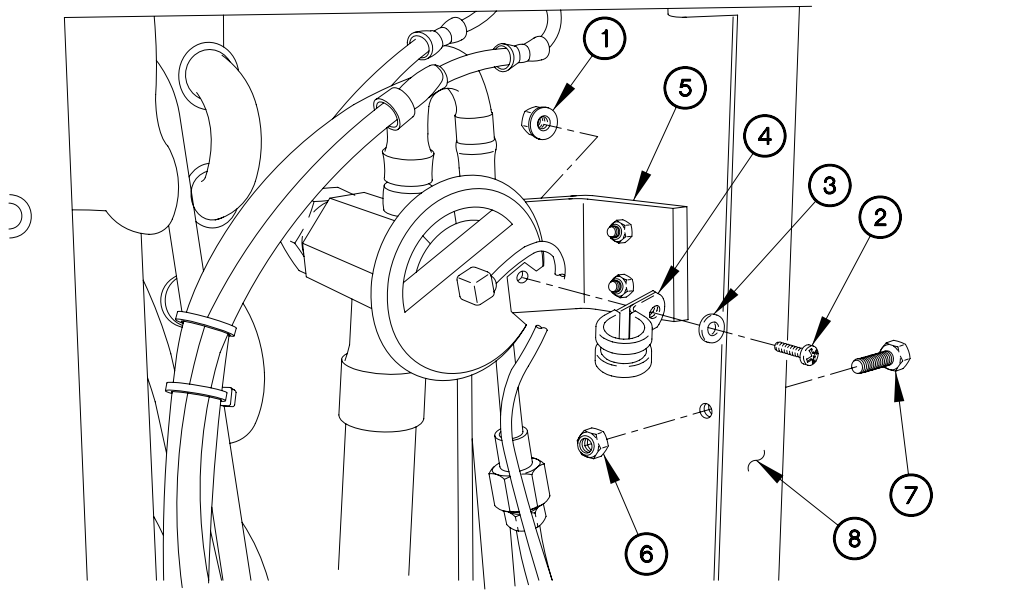


EVAC614X02

Installation - Continued

6. Install two screws (7) in A/C body (8) with two self-locking nuts (6).

7. Install clamp (4) on bracket (5) with washer (3), screw (2), and self-locking nut (1).



EVAC614I01

END OF WORK PACKAGE.

HEATER AND OVER-TEMP SWITCH REPLACEMENT 6.15

THIS WORK PACKAGE COVERS:

INITIAL SETUP:

Maintenance Level
Field

Equipment Conditions
A/C unit removed (para 6.22)
Panel(s) remove (para 6.24)

Tools and Special Tools
Genl Mech Tool Kit (NSN 5180-01-454-3787)
Adhesive (NSN 8040-00-117-8510)

Follow-On Mainenance
Install panel(s) (para 6.24)
Install A/C unit (para 6.22)

Parts Figure
Figure 230-00018-A9

Removal

NOTE

Tag wires and connection points prior to disconnection.

Remove adhesive as required from terminals.

Refer to Table 1 Heater Terminal Connection Wires

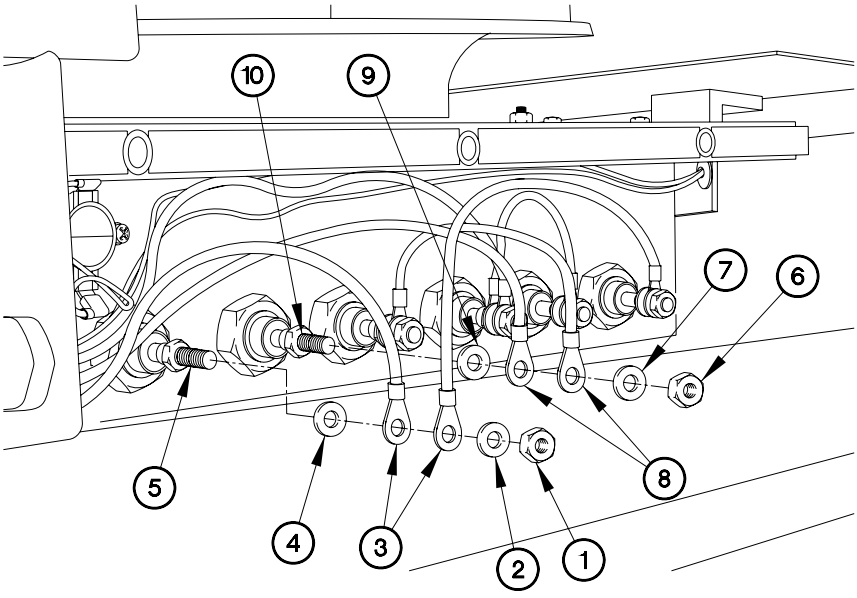
Table 1 Heater Terminal Connection Wires

1	2	3	4	5	6
113 (2)					113
	115 (2)	115			
			114 (2)	114	

Removal - Continued

1. Remove nut (1), washer (2), two wires TL113 (3), and washer (4) from terminal (5).

2. Remove nut (6), washer (7), two wires TL115 (8), and washer (9) from terminal (10).

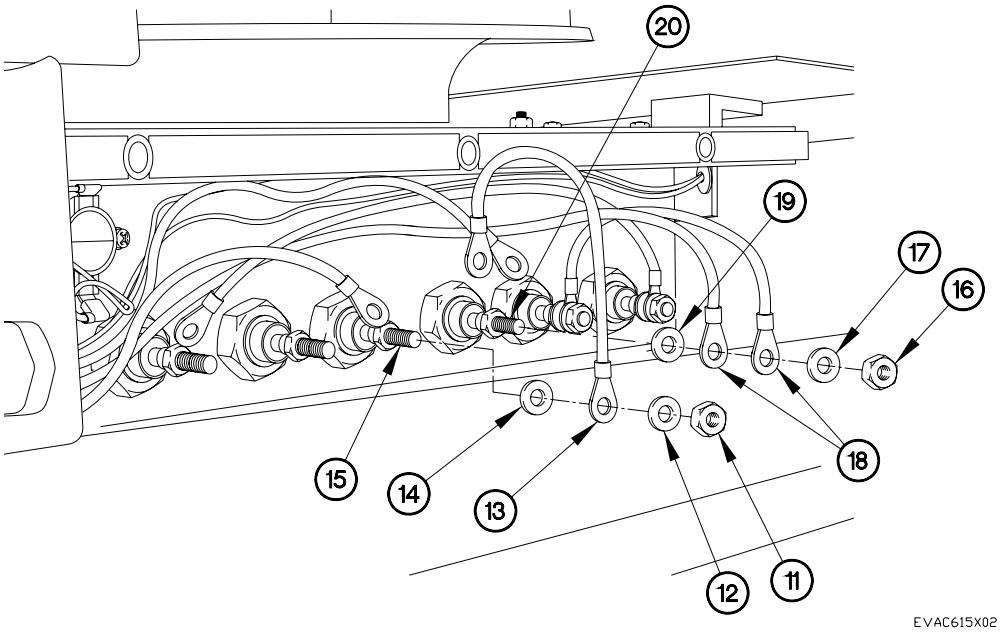


EVAC615X07

Removal - Continued

3. Remove nut (11), washer (12), wire TL115 (13), and washer (14) from terminal (15).

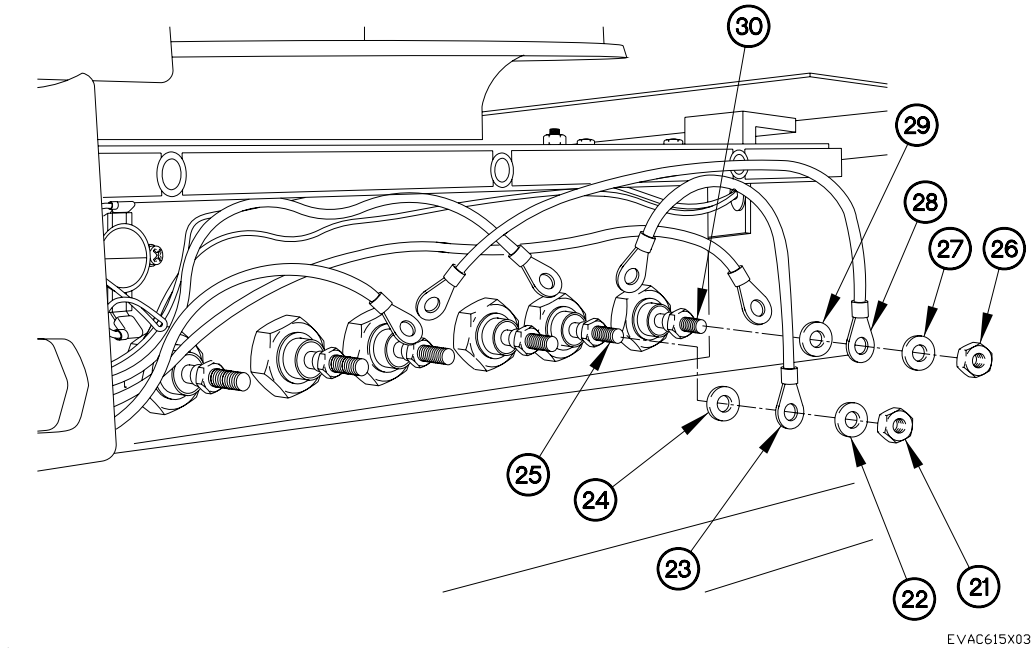
4. Remove nut (16), washer (17), two wires TL114 (18), and washer (19) from terminal (20).



Removal - Continued

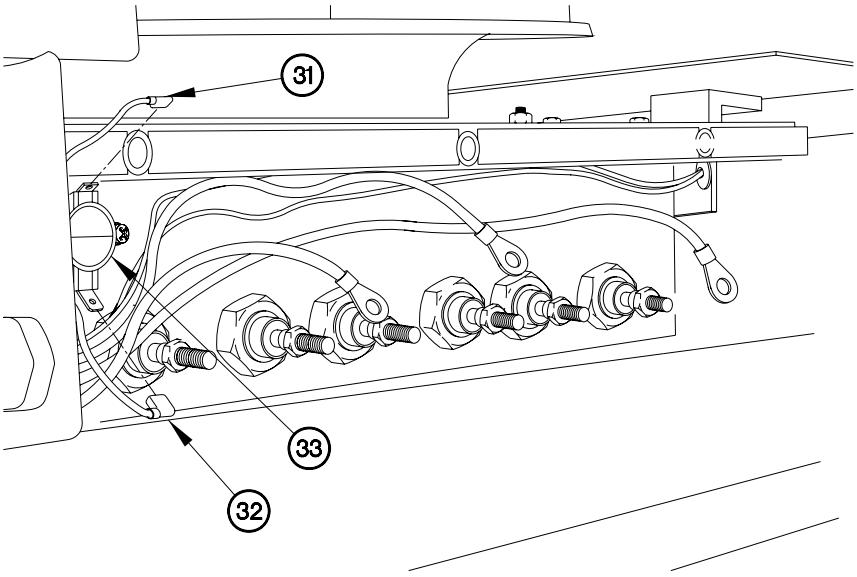
5. Remove nut (21), washer (22), wire TL114 (23), and washer (24) from terminal (25).

6. Remove nut (26), washer (27), wire TL113 (28), and washer (29) from terminal (30).



Removal - Continued

7. Remove terminal lugs TL231 (31) and TL232 (32) from over-temp switch (33).



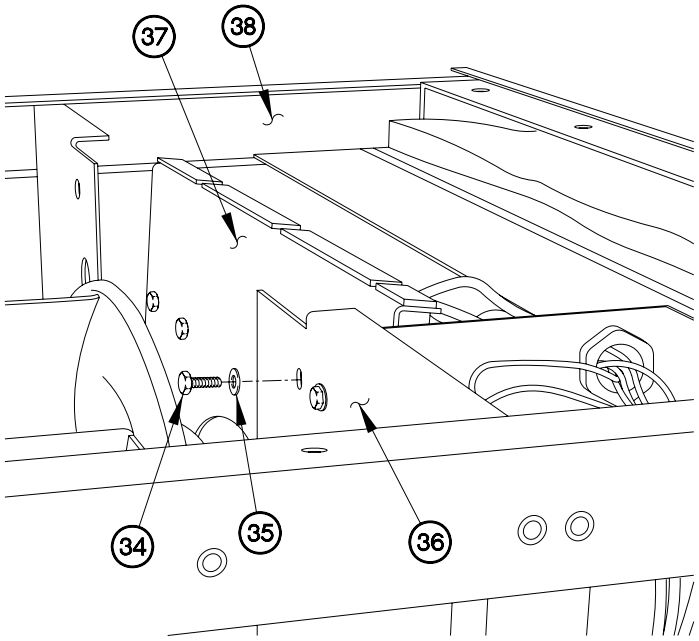
EVAC615X04

Removal - Continued

NOTE

LH and RH sides of heater are removed the same way. LH side shown.

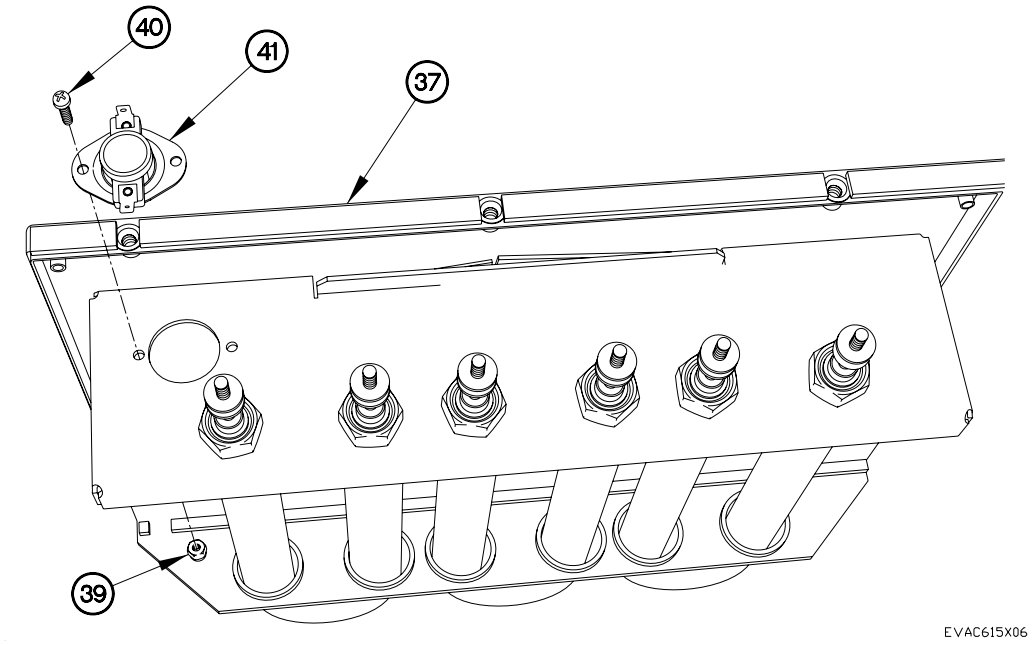
8. Remove five screws (34) and washers (35) from panel (36).
9. Perform previous step on RH side of heater.
10. Remove heater (37) from A/C body (38).



EVAC615X05

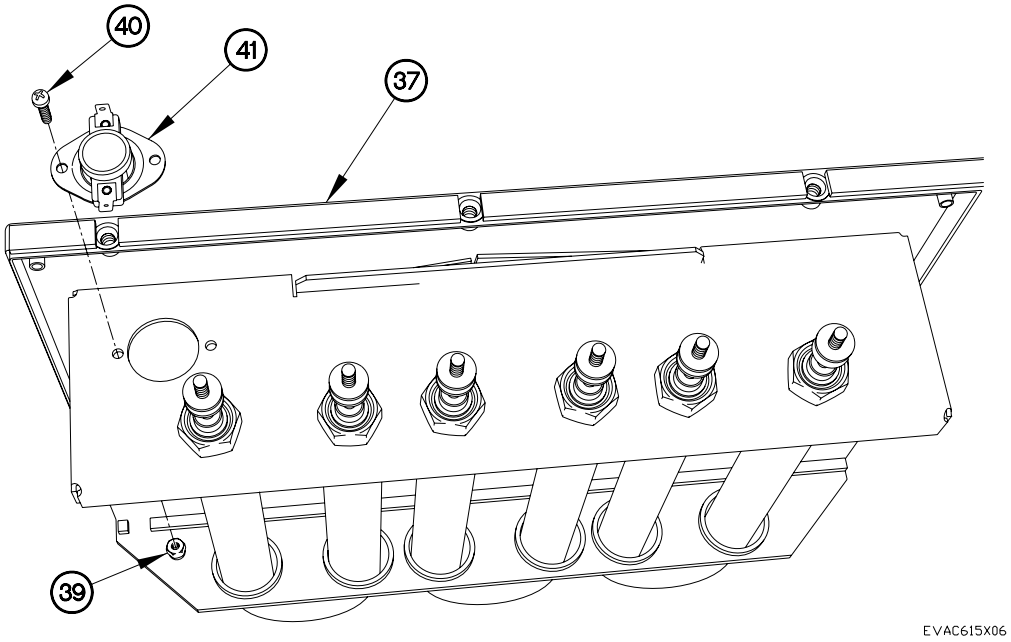
Removal - Continued

11. Remove two self-locking nuts (39), screws (40) and over-temp switch (41) from heater (37).



Installation

1. Install over-temp switch (41) in heater (37) with two screws (40) and self-locking nuts (39).

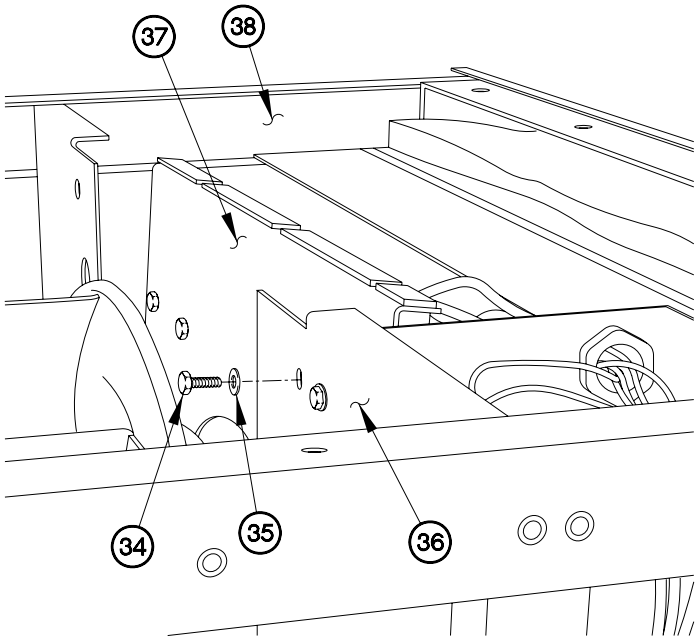


Installation - Continued

NOTE

LH and RH sides of heater are removed the same way. LH side shown.

2. Position heater (37) in A/C body (38).
3. Install five screws (34) and washers (35) in panel (36).
4. Perform previous step on RH side of heater.



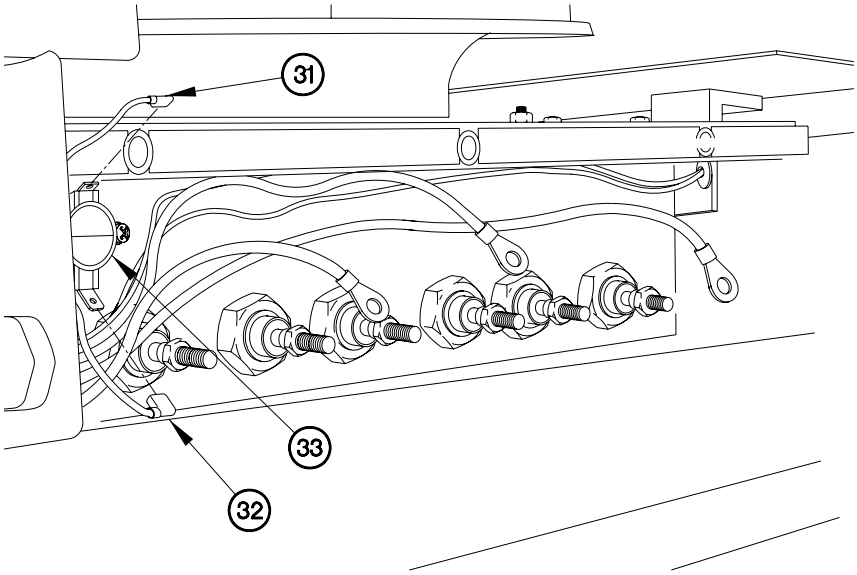
EVAC615X05

Installation - Continued

NOTE

Refer to Table 1 Heater Terminal Connection Wires

5. Install terminal lugs TL231 (31) and TL232 (32) on over-temp switch (33).

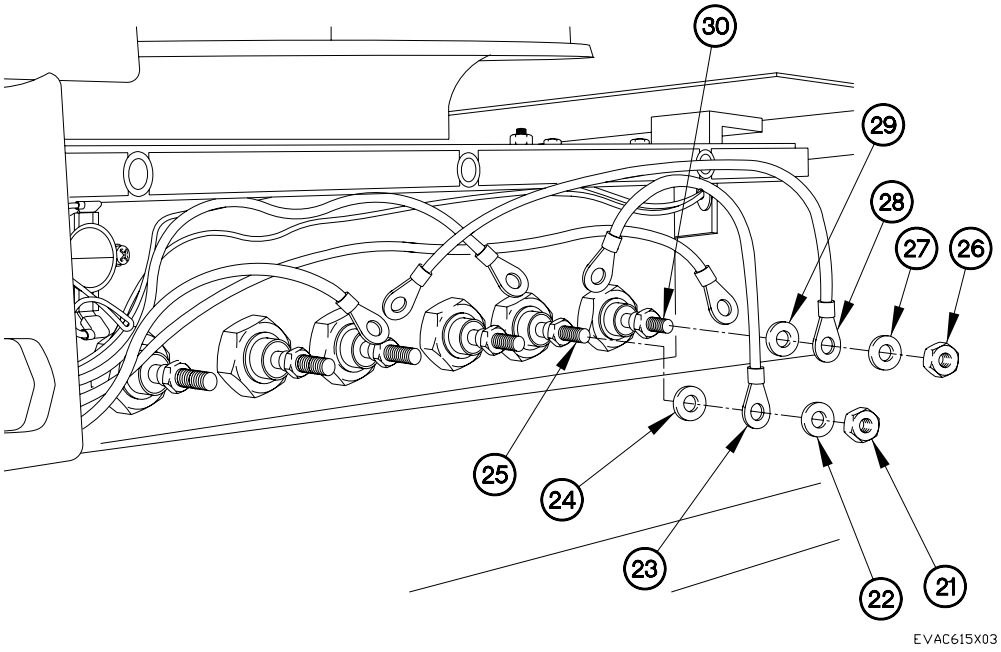


EVAC615X04

Installation - Continued

6. Install washer (29) and wire TL113 (28) on terminal (30) with washer (27) and nut (26).

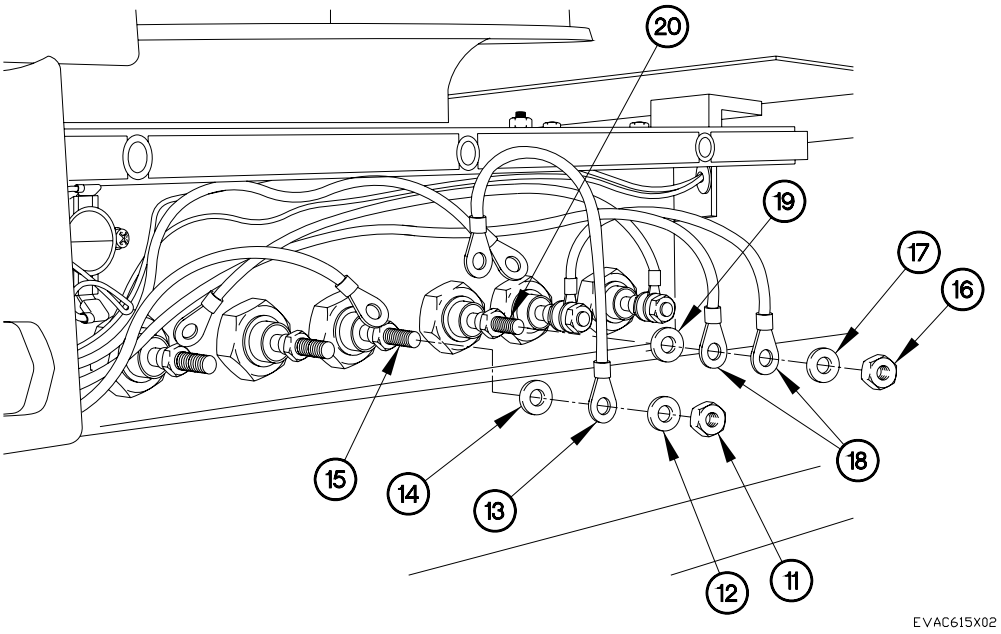
7. Install washer (24) and wire TL114 (23) on terminal (25) with washer (22) and nut (21).



Installation - Continued

8. Install washer (19) and two wires TL114 (18) on terminal (20) with washer (17) and nut (16).

9. Install washer (14) and wire TL115 (13) on terminal (15) with washer (12) and nut (11).

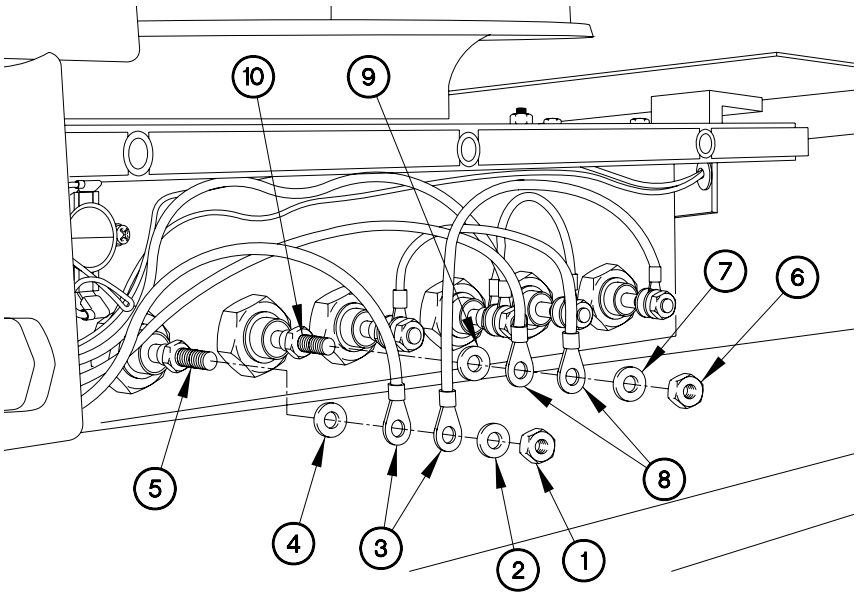


Installation - Continued

10. Install washer (9) and two wires TL115 (8) on terminal (10) with washer (7) and nut (6).

11. Install washer (4) and two wires TL113 (3) on terminal (5) with washer (2) and nut (1).

12. Apply adhesive to terminals.



EVAC615I01

END OF WORK PACKAGE.

CONTACTOR REPLACEMENT 6.16

THIS WORK PACKAGE COVERS:

INITIAL SETUP:

Maintenance Level
Field

Equipment Conditions
Engine shut down (392-10)
Generator disconnected
Sides expanded/platform installed (392-10)
A/C panel(s) removed (para 6.24)
Panel(s) removed (para 6.24)

Tools and Special Tools
Genl Mech Tool Kit (NSN 5180-01-454-3787)

Follow-On Mainenance
Connect generator
Install panel(s) (para 6.24)
Operate A/C, checking for proper operation (Chapter 5)
Stow platform/ compress sides (392-10)
Install A/C panel(s) (para 6.24)

Parts Figure
Figure 230-00018-A4

Removal

NOTE

If replacing bottom contactors, top contactors must be removed for ease of access.

Tag wires and connection points prior to disconnection.

Refer to Table 1 Contactor Terminal Connection Wires

Table 1 Contactor Terminal Connection Wires

	CONTACTOR 1MC		
Outer	Terminal 1	Terminal 2	Terminal 3
	L1	L2	L3
Inner	Terminal 1	Terminal 2	Terminal 3
			212
Inner	Terminal 4	Terminal 5	Terminal 6
			200
Outer	Terminal 4	Terminal 5	Terminal 6
	10	11	12

CONTACTOR HC1		
Terminal 1	Terminal 2	Terminal 3
L1	L2	L3
Terminal 1	Terminal 2	Terminal 3
		232
Terminal 4	Terminal 5	Terminal 6
		200 (X2)
Terminal 4	Terminal 5	Terminal 6
113	114	115

	CONTACTOR 4MH		
Outer	Terminal 1	Terminal 2	Terminal 3
	L1	L2	L3
Inner	Terminal 1	Terminal 2	Terminal 3
		219	217
Inner	Terminal 4	Terminal 5	Terminal 6
		218	200 (X2)
Outer	Terminal 4	Terminal 5	Terminal 6
	40	41	42

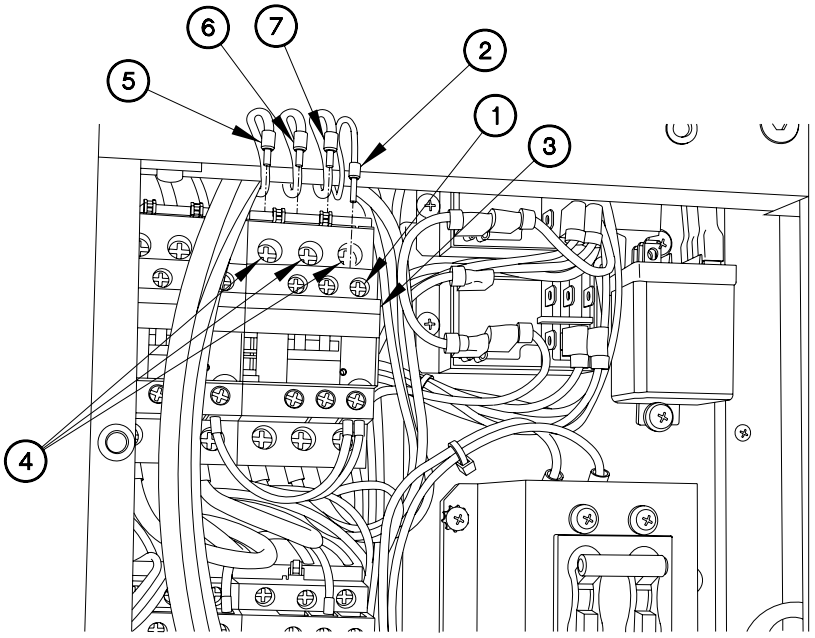
CONTACTOR 4ML		
Terminal 1	Terminal 2	Terminal 3
L1	L2	L3
Terminal 1	Terminal 2	Terminal 3
	217	219
Terminal 4	Terminal 5	Terminal 6
	216	200 (X2)
Terminal 4	Terminal 5	Terminal 6
43	44	45

Removal - Continued

NOTE

All contactors are removed the same way. Contactor HC1 shown.

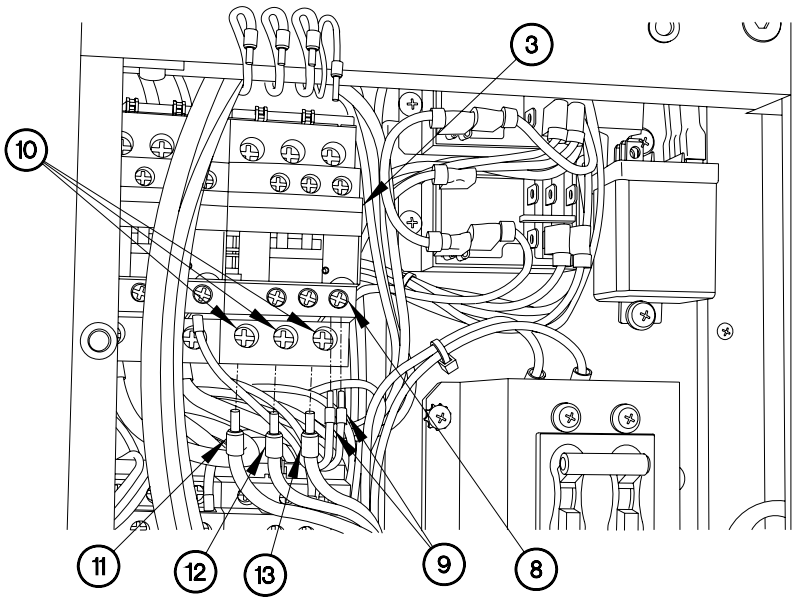
1. Loosen screw (1) on wire 232 (2).
2. Remove wire 232 (2) from contactor (3).
3. Loosen three screws (4) on wires L1, L2, and L3 (5, 6, and 7).
4. Remove wires L1, L2, and L3 (5 , 6, and 7) from contactor (3).



E:VAC616X01

Removal - Continued

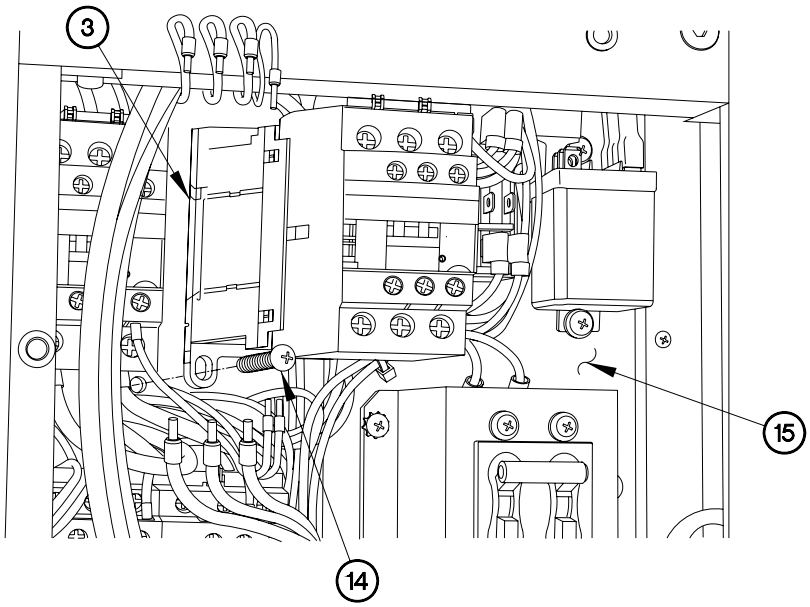
5. Loosen screw (8) on two wires 200 (9).
6. Remove two wires 200 (9) from contactor (3).
7. Loosen three screws (10) on wires 113, 114, and 115 (11, 12, and 13).
8. Remove wires 113, 114, and 115 (11, 12, and 13) from contactor (3).



EVAC616X02

Removal - Continued

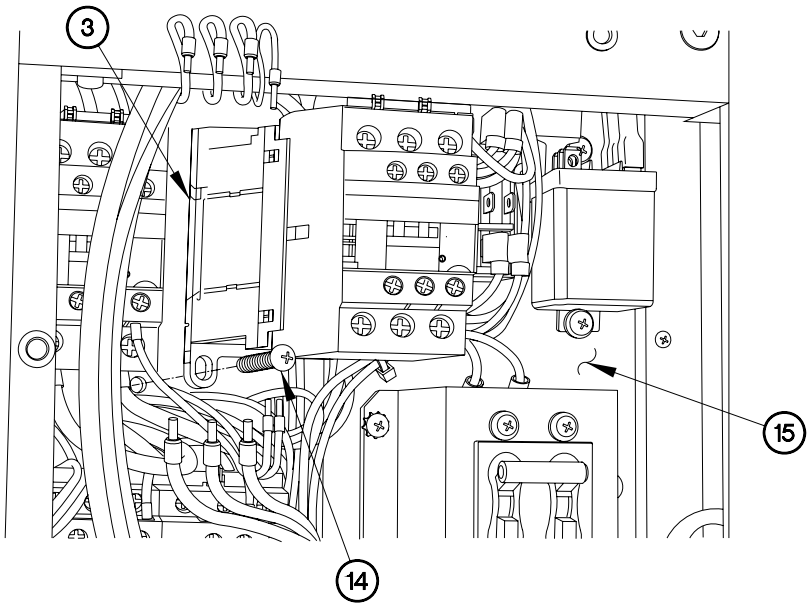
9. Remove two screws (14) and contactor (3) from panel (15).



EVAC616X03

Installation

1. Install contactor (3) on panel (15) with two screws (14).



EVAC616X03

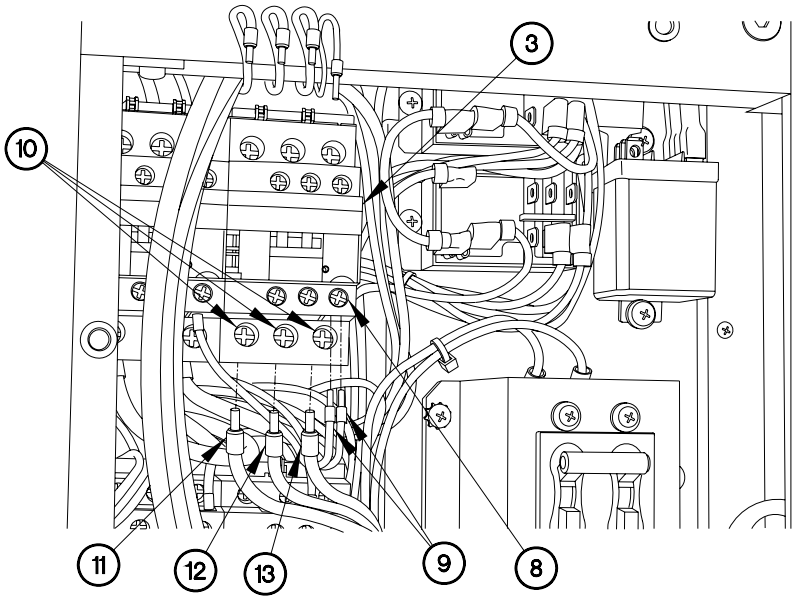
Installation - Continued

NOTE

All contactors are installed the same way. Contactor HC1 shown.

Refer to Table 1 Contactor Terminal Connection Wires

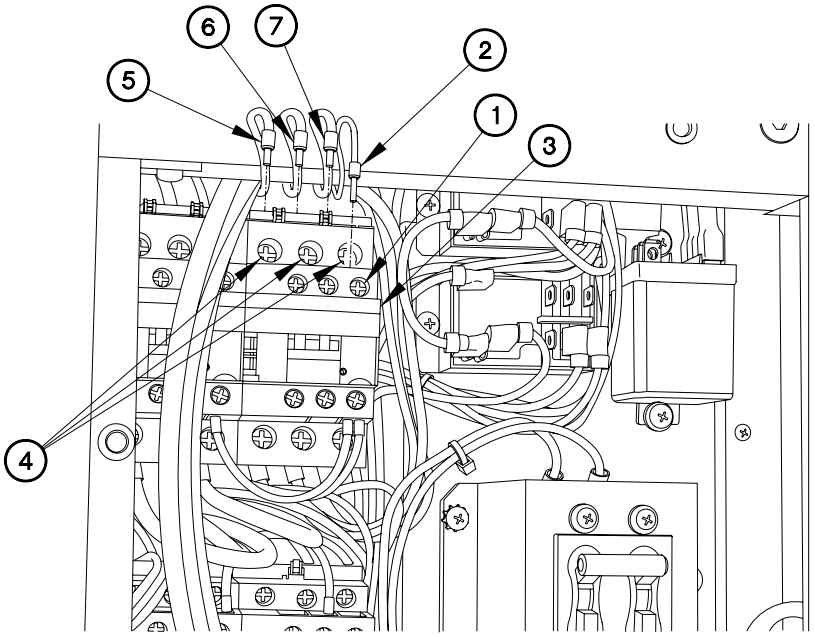
2. Install wires 113, 114, and 115 (11, 12, and 13) in contactor (3).
3. Tighten three screw (10) on wires 113, 114, and 115 (11, 12, and 13).
4. Install two wires 200 (9) in contactor (3).
5. Tighten screw (8) on two wires 200 (9).



EVAC616X02

Installation - Continued

6. Install wires L1, L2, and L3 (5, 6, and 7) in contactor (3).
7. Tighten three screws (4) on wires L1, L2, and L3 (5, 6, and 7).
8. Install wire 232 (2) in contactor (3).
9. Tighten screw (1) on wire 232 (2).



EVAC616X01

END OF WORK PACKAGE.

CAPACITORS AND BRACKET REPLACEMENT 6.17

THIS WORK PACKAGE COVERS:

INITIAL SETUP:

Maintenance Level
Field

Equipment Conditions
Contactors removed (para 6.16)

Tools and Special Tools
Genl Mech Tool Kit (NSN 5180-01-454-3787)

Follow-On Maintenance
Install contactors (para 6.16)
Bench test unit (para 6.25)

Parts Figure
Figure 230-00018-A4

Removal

NOTE

Tag wires and connection points prior to disconnection.

Refer to Table 1 Capacitor Terminal Connection Wires

Table 1 Capacitor Terminal Connection Wires

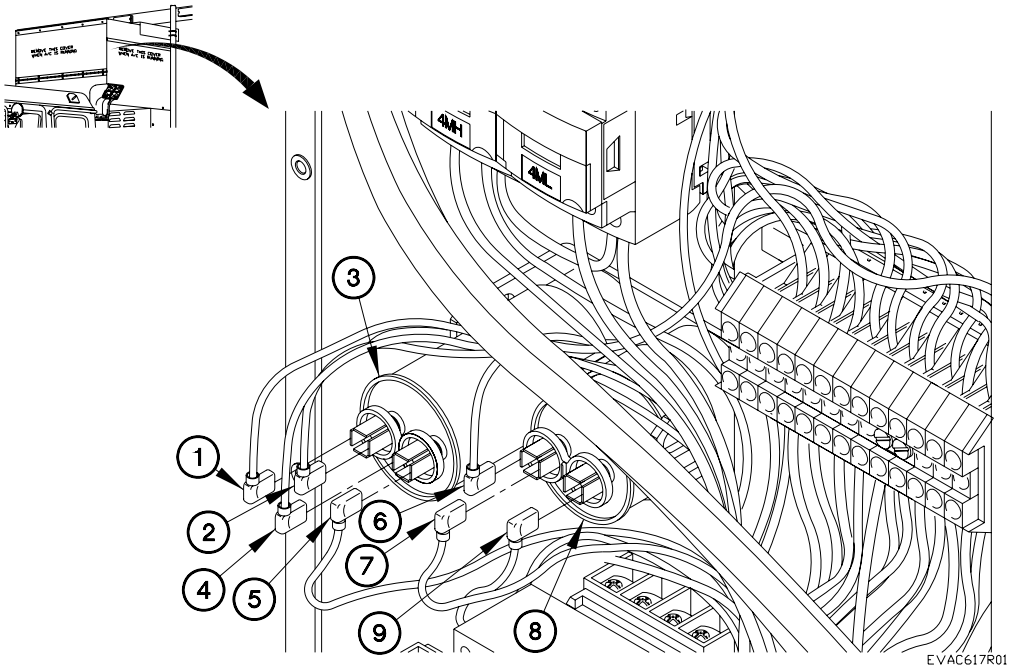
Capacitor L3/35							Capacitor 33/34					
	Blank			Blank				Blank			Blank	
L3		L3	35		35		33		33	Blank		34
	Blank			Blank				Blank			Blank	

Removal - Continued

Note

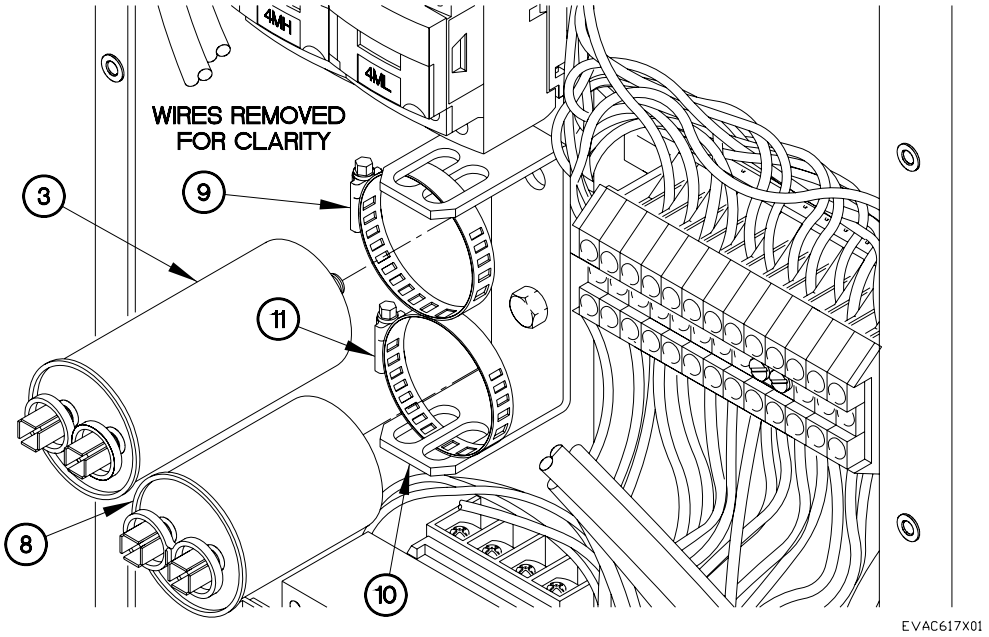
Remove plastic cable ties as required.

1. Disconnect wires L3 (1 and 2) from capacitor (3).
2. Disconnect wires 35 (4 and 5) from capacitor (3).
3. Disconnect wires 33 (6 and 7) from capacitor (8).
4. Disconnect wire 34 (9) from capacitor (8).
5. Rotate capacitors (3 and 8) 90-degrees.



Removal - Continued

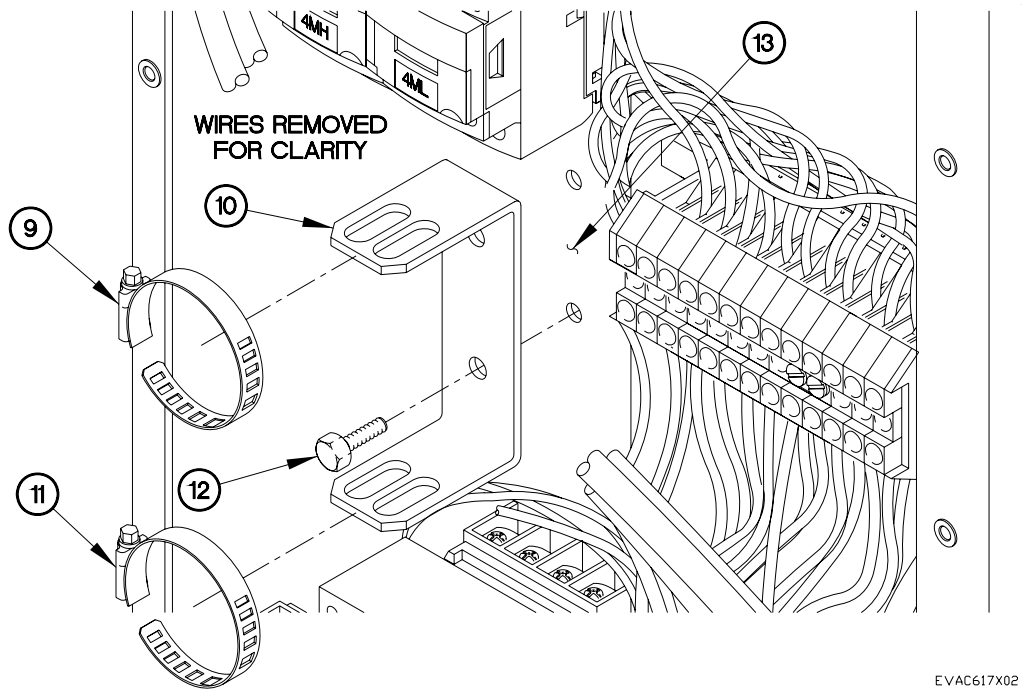
6. Loosen clamp (9) on capacitor (3).
7. Remove capacitor (3) from bracket (10).
8. Loosen clamp (11) on capacitor (8).
9. Remove capacitor (8) from bracket (10).



Removal - Continued

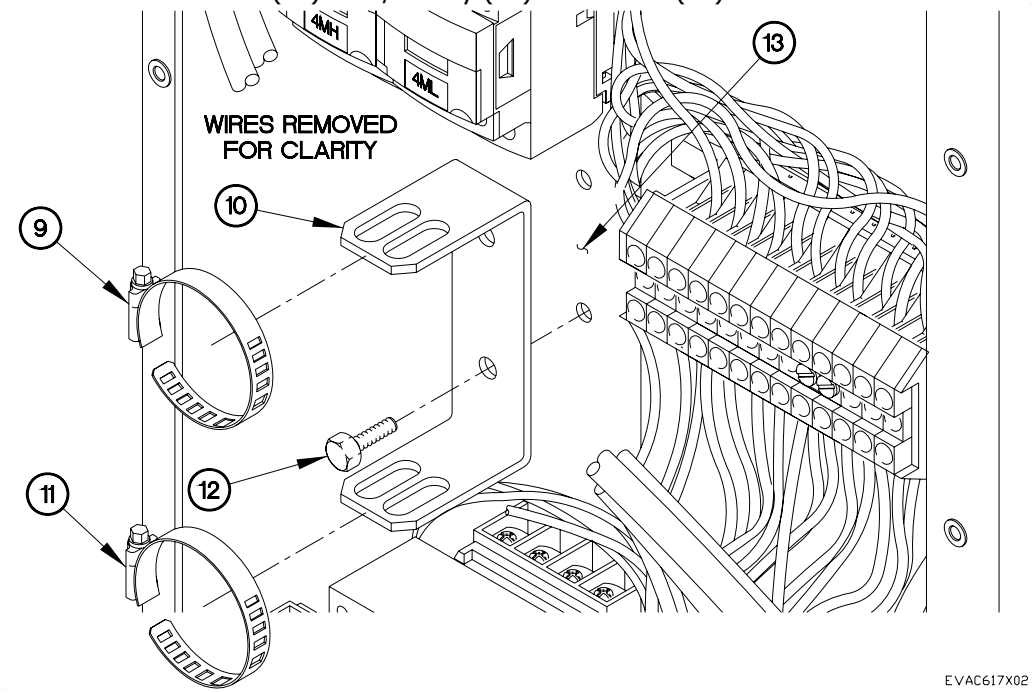
10. Remove screw (12) and bracket (10) from A/C body (13).

11. Remove clamps (9 and 11) from bracket (10).



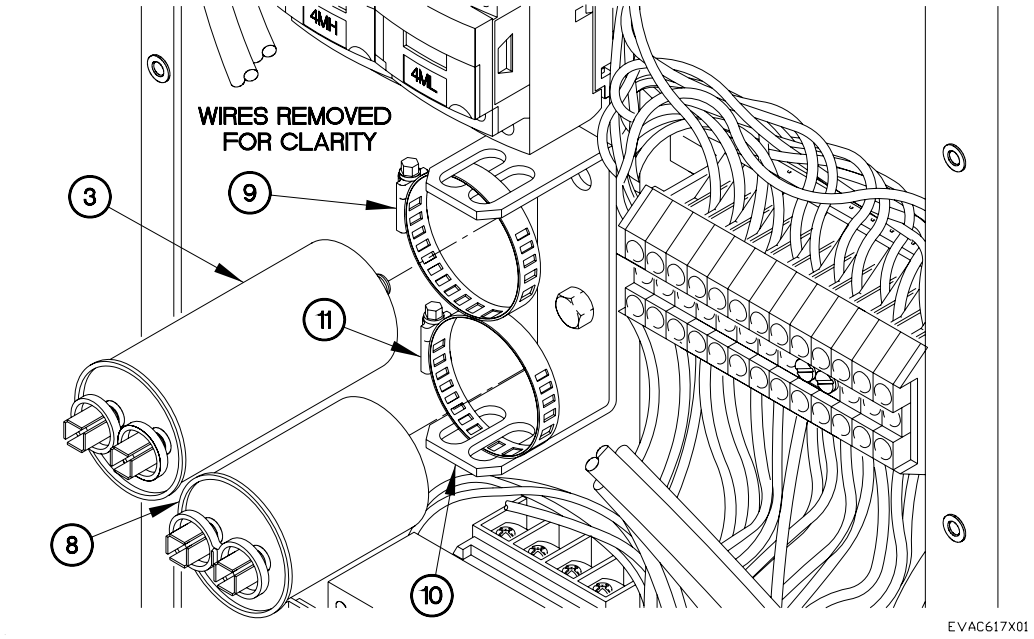
Installation

1. Install clamps (9 and 11) in bracket (10).
2. Install bracket (10) on A/C body (13) with screw (12).



Installation – Continued

3. Install capacitor (8) in bracket (10) with clamp (11).
4. Install capacitor (3) in bracket (10) with clamp (9).

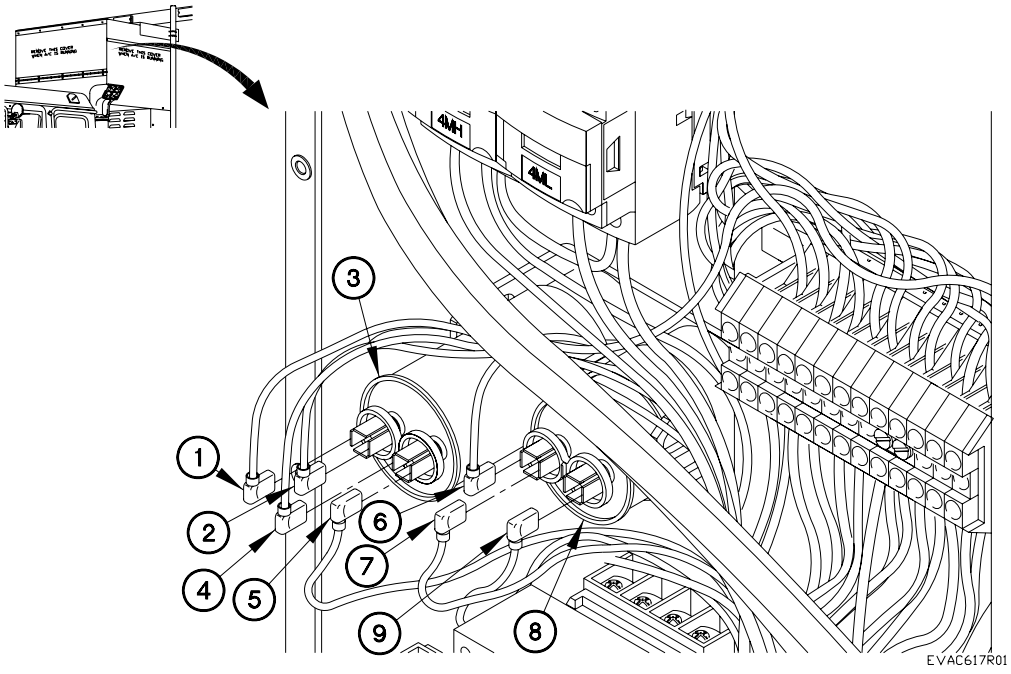


Installation - Continued

Note

Install plastic cable ties as required.

5. Rotate capacitors (3 and 8) 90-degrees.
6. Connect wire 34 (9) to capacitor (8).
7. Connect wires 33 (6 and 7) to capacitor (8).
8. Connect wires 35 (4 and 5) to capacitor (3).
9. Connect wires L3 (1 and 2) to capacitor (3).



END OF WORK PACKAGE.

TRANSFORMER REPLACEMENT 6.18

THIS WORK PACKAGE COVERS:

INITIAL SETUP:

Maintenance Level
Field

Equipment Conditions
Capacitor and bracket removed (para 6.17)

Tools and Special Tools
Genl Mech Tool Kit (NSN 5180-01-454-3787)

Follow-On Mainenance
Install capacitors and bracket (para 6.17)
Bench test unit (para 6.25)

Parts Figure
Figure 230-00018-A4

Removal

NOTE

Tag wires and connection points prior to disconnection.

Refer to Table 1 Transformer Terminal Connection Wires

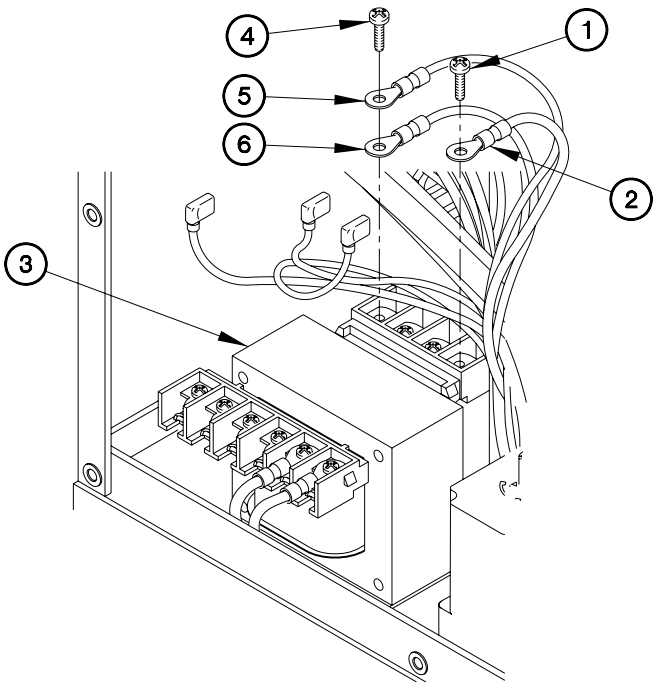
Table 1 Transformer Terminal Connection Wires

	200 (X2), Green	Blank	Blank	201	
Blank	Blank	Blank	Blank	L3A	L1A

Removal - Continued

1. Remove screw (1) and wire 201 (2) from transformer (3).

2. Remove screw (4), two wires 200 (5) and green wire (ground) (6) from transformer (3).

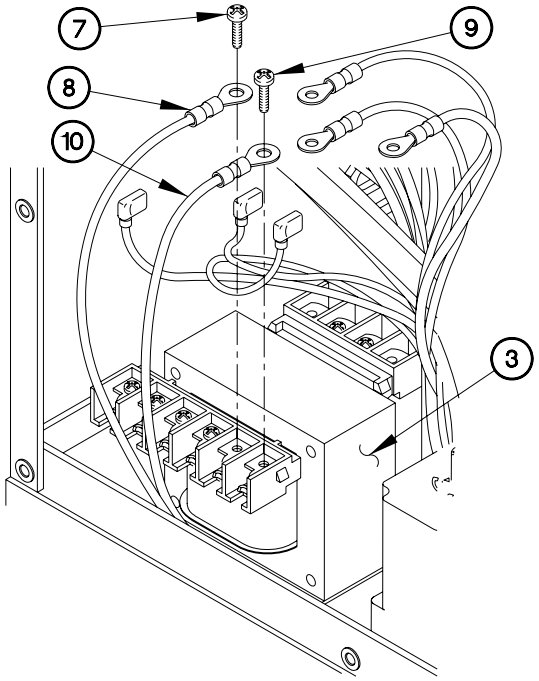


EVAC618X01

Removal - Continued

3. Remove screw (7) and wire L3A (8) from transformer (3).

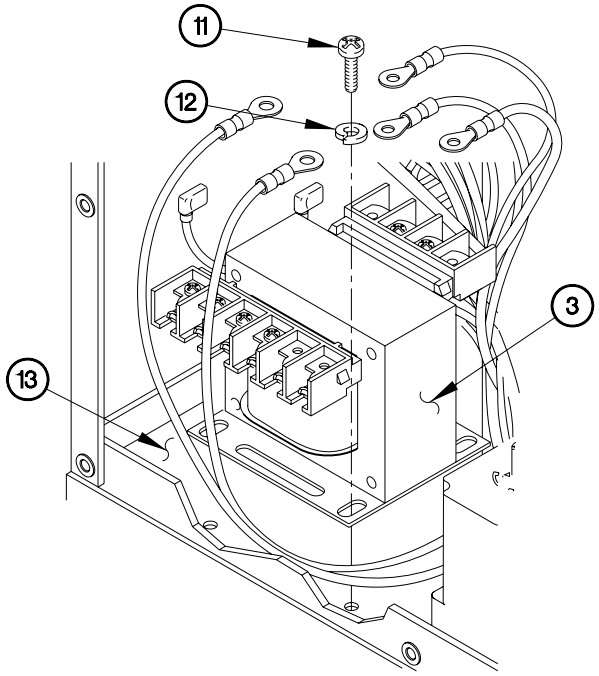
4. Remove screw (9) and wire L1A (10) from transformer (3).



EVAC618X02

Removal - Continued

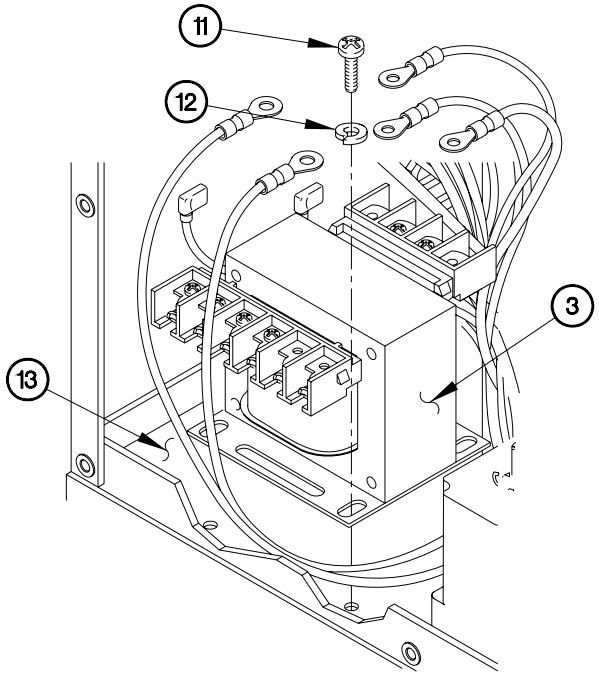
5. Remove four screws (11), lockwashers (12) and transformer (3) from A/C body (13).



EVAC618X03

Installation

1. Install transformer (3) in A/C body (13) with four lockwashers (12) and screws (11).



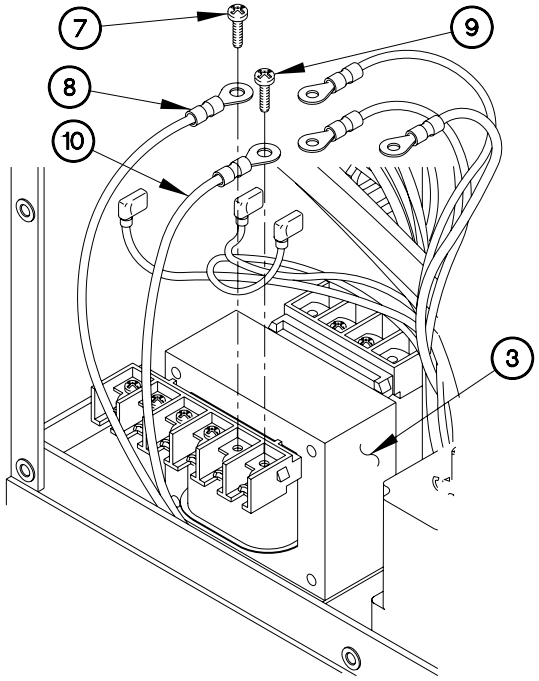
EVAC618X03

Installation - Continued

NOTE

Refer to Table 1 Transformer Terminal Connection Wires

2. Install wire L1A (10) in transformer (3) with screw (9).
3. Install wire L3A (8) in transformer (3) with screw (7).

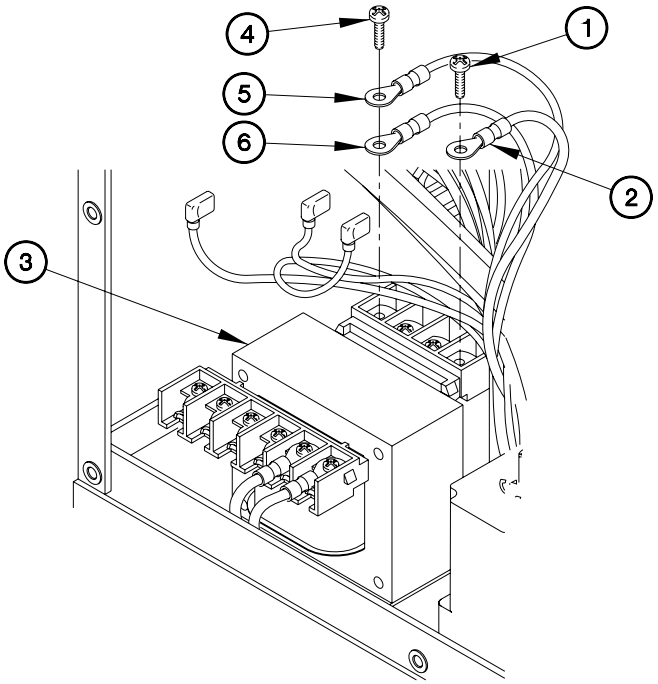


EVAC618X02

Installation - Continued

4. Install two wires 200 (5) and green wire (ground) (6) on transformer (3) with screw (4).

5. Install wire 201 (2) on transformer (3) with screw (1).



EVAC618X01

END OF WORK PACKAGE.

RELAYS REPLACEMENT 6.19

THIS WORK PACKAGE COVERS:

INITIAL SETUP:

Maintenance Level
Field

Equipment Conditions
Engine shut down
Generator disconnected
Sides expanded/platform installed (392-10)
A/C panel(s) removed (para 6.24)

Tools and Special Tools
Genl Mech Tool Kit (NSN 5180-01-454-3787)

Follow-On Mainenance
Connect generator
Operate A/C, checking for proper Operation (Chapter 5)
Install A/C panel(s) (para 6.24)
Stow platform/compress sides (392-10)

Parts Figure
Figure 230-00018-A4

Relays 3MC and R2 Removal

NOTE

Tag wires and connection points prior to disconnection.

Both relays 3MC and R2 are removed the same way, 3MC shown.

Refer to Table 1 Relays 3MC and R2 Terminal Connection Wires

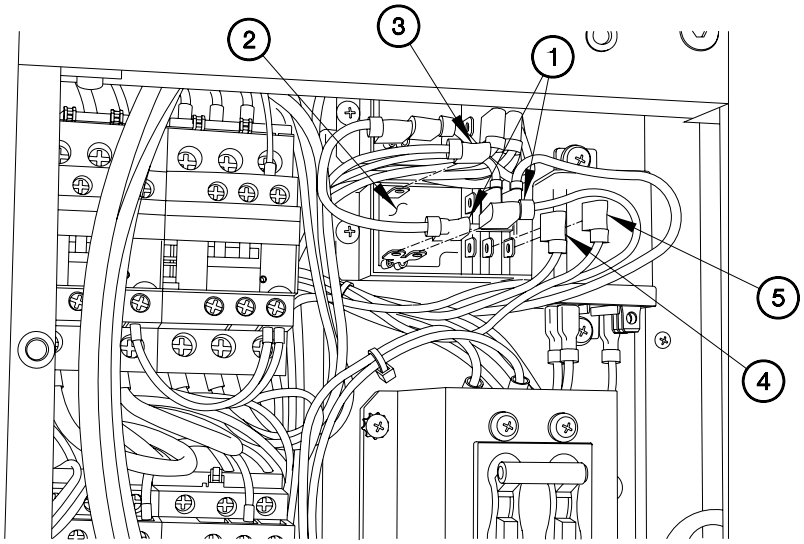
Table 1 Relays 3MC and R2 Terminal Connection Wires

R2			
220	N/A	N/A	N/A
200 (X2)	N/A	215	213

3MC			
210	N/A	231	230
200 (X2)	N/A	33	L1

Relays 3MC and R2 Removal - Continued

1. Disconnect two wires 200 (1) from relay 3MC (2).
2. Disconnect wire 210 (3) from relay 3MC (2).
3. Disconnect wires 33 (4) and L1 (5) from relay 3MC (2).

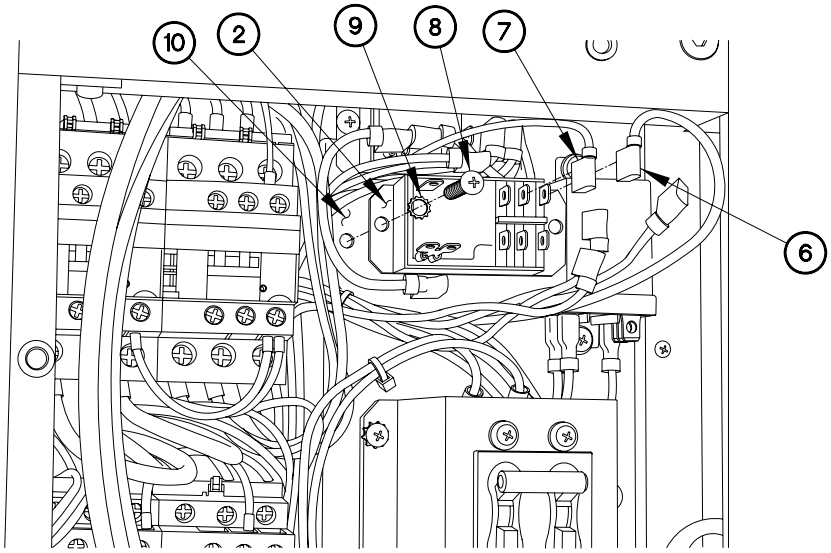


EVAC619X01

Relays 3MC and R2 Removal – Continued

4. Disconnect wires 230 (6) and 231 (7) from relay 3MC (2).

5. Remove two screws (8), lockwashers (9), and relay 3MC (2) from A/C unit (10).



EVAC619X02

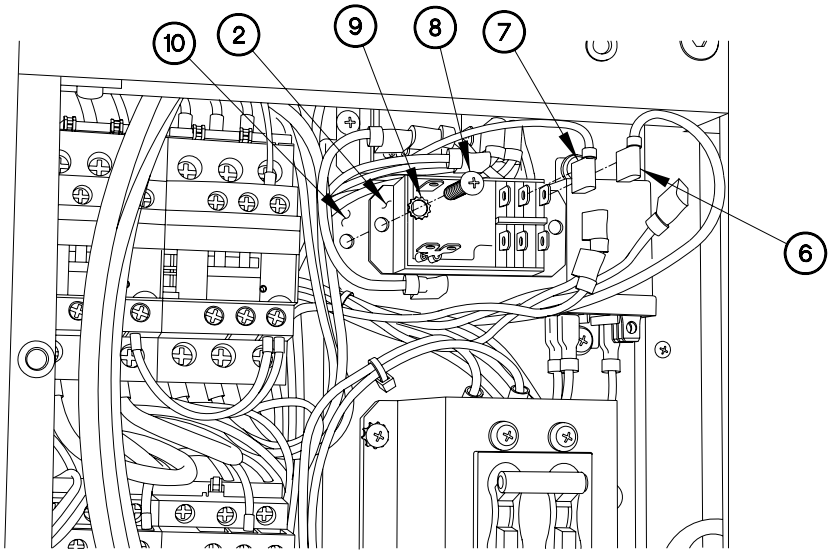
Relays 3MC and R2 Installation

NOTE

Both relays 3MC and R2 are installed the same way, 3MC shown.

Refer to Table 1 Relays 3MC and R2 Terminal Connection Wires

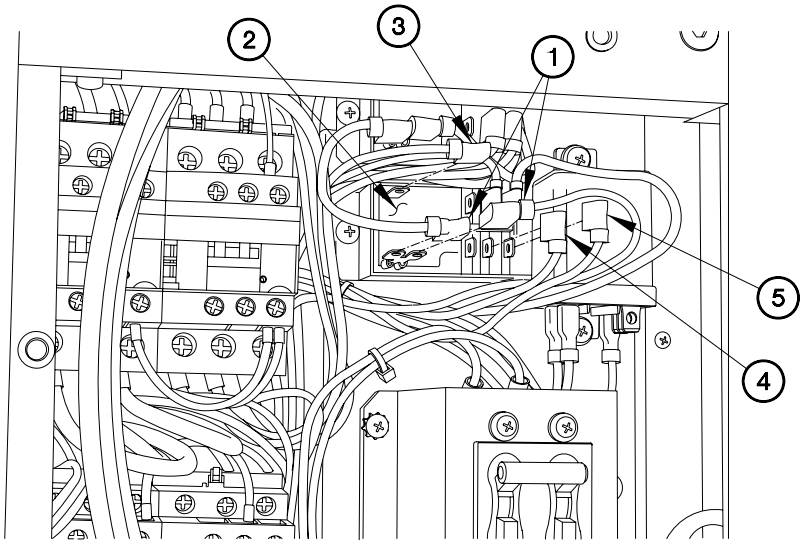
1. Install relay 3MC (2) on A/C unit (10) with two lockwashers (9) and screws (8).
2. Connect wires 230 (6) and 231 (7) to relay 3MC (2).



EVAC619X02

Relays 3MC and R2 Installation - Continued

3. Connect wires 33 (4) and L1 (5) to relay 3MC (2).
4. Connect wire 210 (3) to relay 3MC (2).
5. Connect two wires 200 (1) to relay 3MC (2).



EVAC619X01

Relay R4 Removal

NOTE

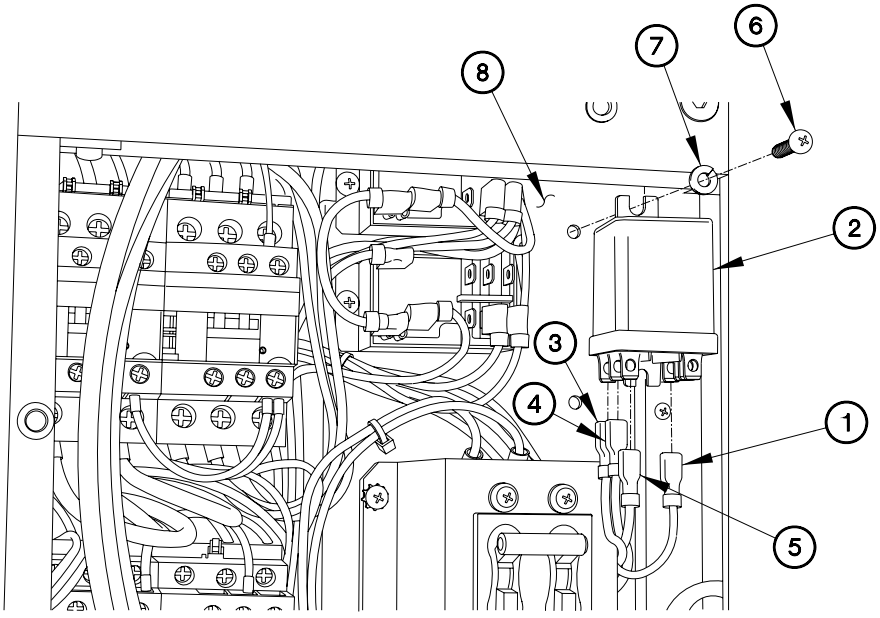
Tag wires and connection points prior to disconnection.

Refer to Table 2 Relay R4 Terminal Connection Wires

Table 1 Relay R4 Terminal Connection Wires

R4	
200	225
N/A	35
N/A	N/A
N/A	L3

1. Disconnect wire 200 (1) from relay R4 (2).
2. Disconnect wires 225 (3), 35 (4), and L3 (5) from relay R4 (2)
3. Remove two screws (6), lockwashers (7), and relay R4 (2) from A/C unit (8).



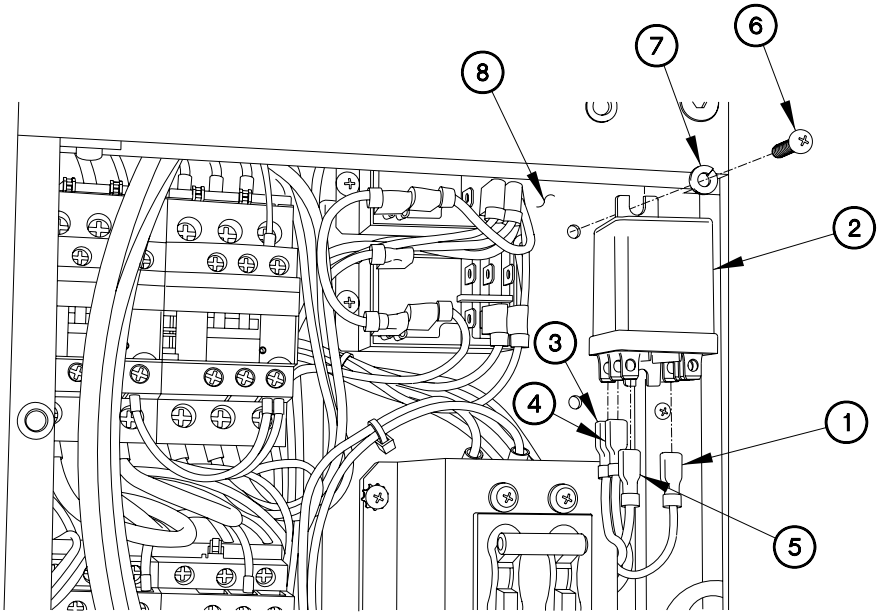
EVAC619X03

Relay R4 Installation

NOTE

Refer to Table 2 Relay R4 Terminal Connection Wires

1. Install relay R4 (2) in A/C unit (8) with two lockwashers (7) and screws (6).
2. Connect wires 225 (3), 35 (4), and L3 (5) to relay R4 (2)
3. Connect wire 200 (1) to relay R4 (2).



EVAC619X03

END OF WORK PACKAGE.

CIRCUIT BREAKERS REPLACEMENT 6.20

THIS WORK PACKAGE COVERS:

INITIAL SETUP:

Maintenance Level
Field

Equipment Conditions
Engine shut down (392-10)
Generator disconnected
Sides expanded/platform installed (392-10)
Panel(s) removed (para 6.24)

Tools and Special Tools
Genl Mech Tool Kit (NSN 5180-01-454-3787)

Follow-On Mainenance
Connect generator
Operate A/C, checking for proper Operation (Chapter 5)
Install panel(s) (para 6.24)
Stow platform/compress sides (392-10)

Parts Figure
Figure 230-00018-A4

Circuit Breaker CB1 Removal

NOTE

Tag wires and connection points prior to disconnection.

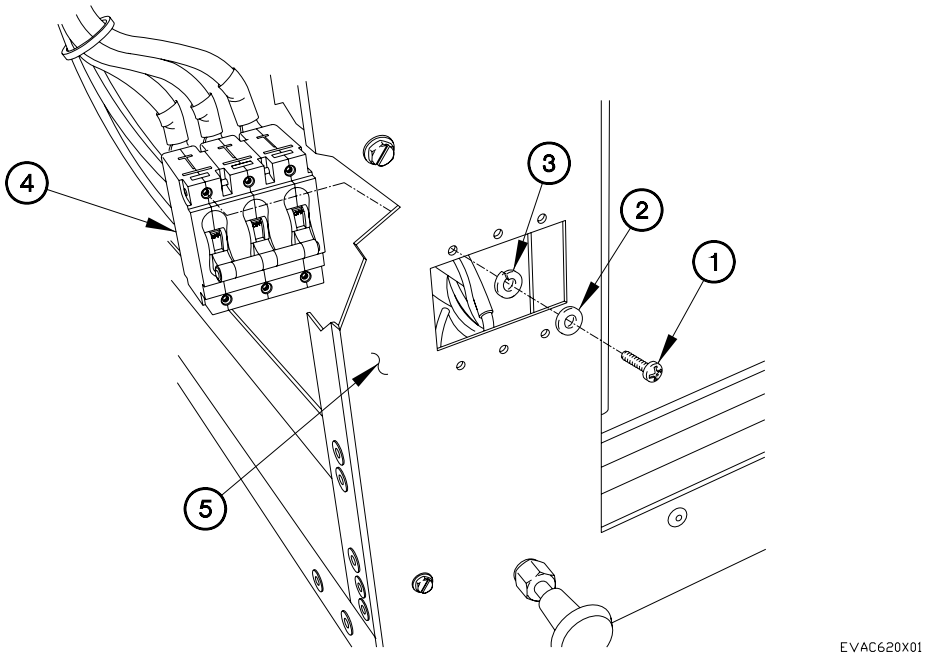
Refer to Table 1 Circuit Breaker CB1 Terminal Connection Wires

Table 1 Circuit Breaker CB1 Terminal Connection Wires

CB1		
L3	L2	L1
L3 (X4)	L2 (X2)	L1 (X3)

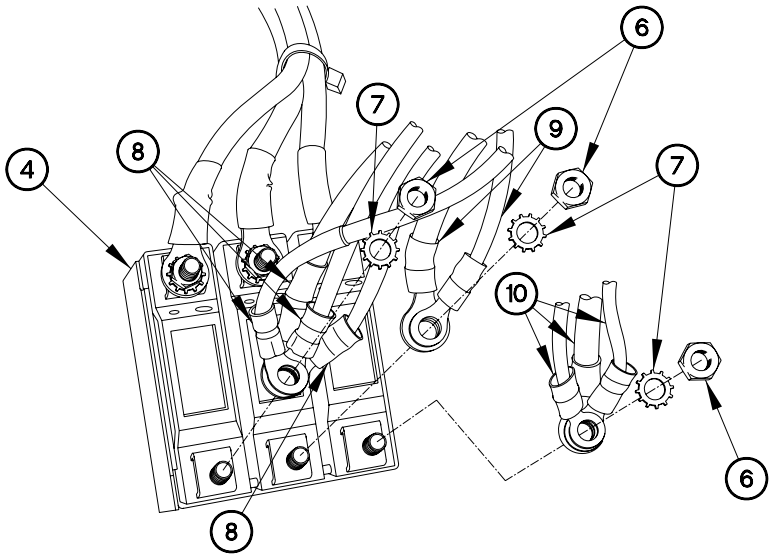
CB1 Removal - Continued

1. Remove six screws (1), washers (2), lockwashers (3) and CB1 (4) from A/C body (5).



CB1 Removal - Continued

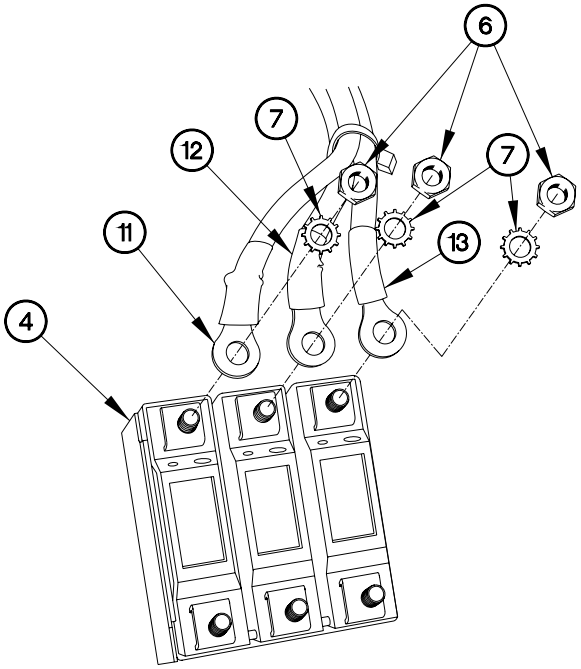
2. Remove nut (6), lockwasher (7), and four wires L3 (8) from CB1 (4).
3. Remove nut (6), lockwasher (7), and two wires L2 (9) from CB1 (4).
4. Remove nut (6), lockwasher (7), and three wires L1 (10) from CB1 (4).



EVAC620X02

CB1 Removal - Continued

5. Remove nut (6), lockwasher (7), and wire L3 (11) from CB1 (4).
6. Remove nut (6), lockwasher (7), and wire L2 (12) from CB1 (4).
7. Remove nut (6), lockwasher (7), and wire L1 (13) from CB1 (4).



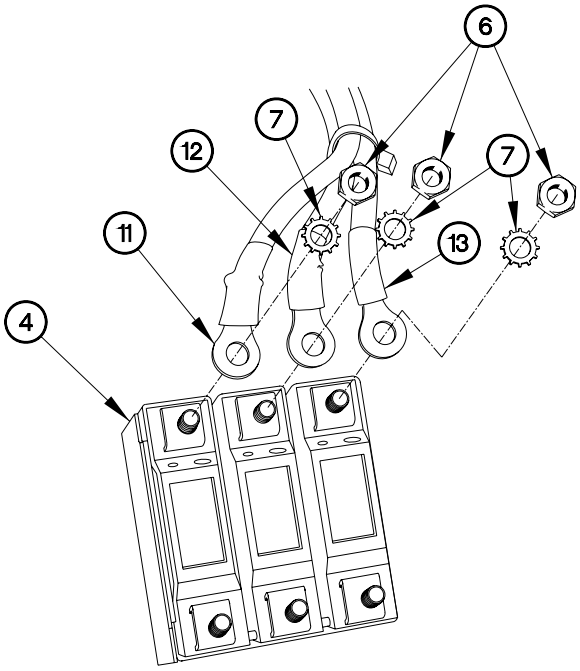
EVAC620X03

CB1 Installation

NOTE

Refer to Table 1 Circuit Breaker CB1 Terminal Connection Wires

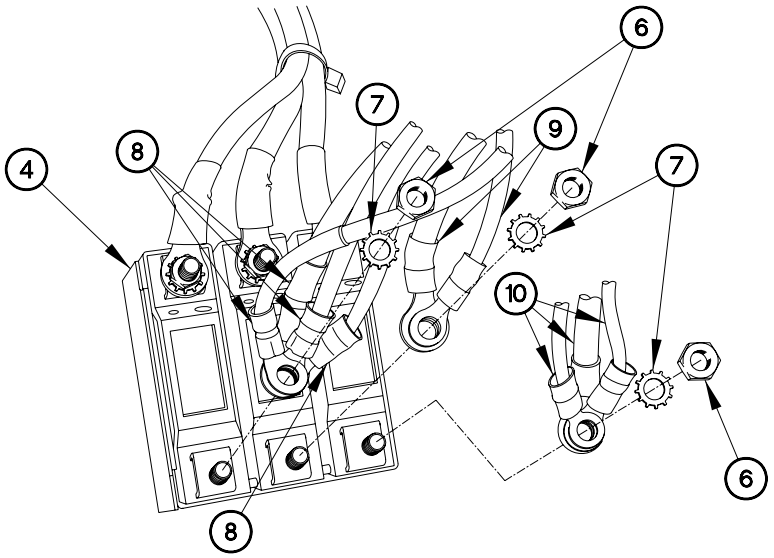
1. Install wire L1 (13) on CB1 (4) with lockwasher (7) and nut (6).
2. Install wire L2 (12) on CB1 (4) with lockwasher (7) and nut (6).
3. Install wire L1 (11) on CB1 (4) with lockwasher (7) and nut (6).



EVAC620X03

CB1 Installation - Continued

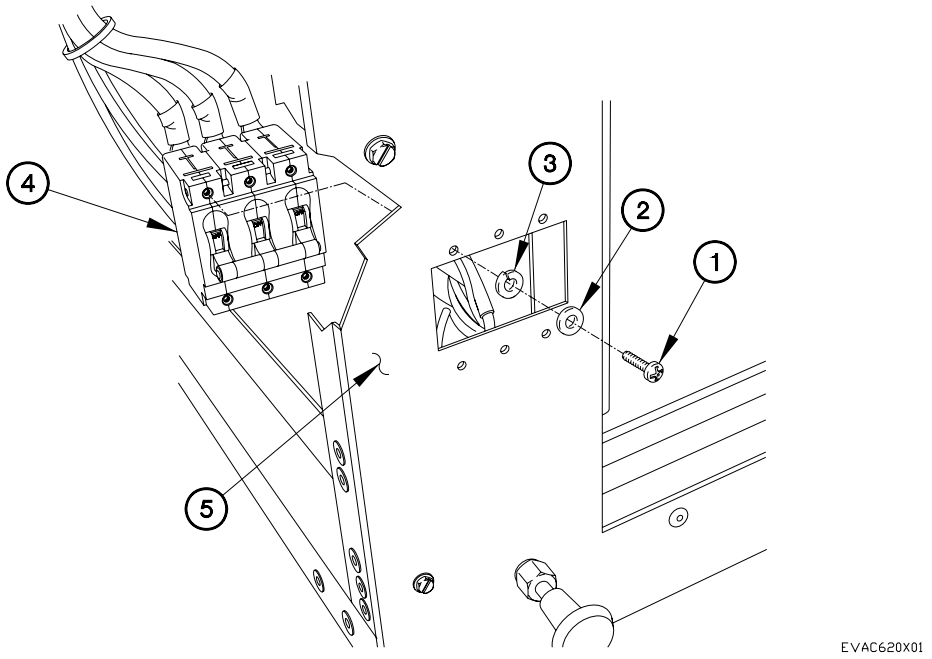
4. Install three wires L1 (10) on CB1 (4) with lockwasher (7) and nut (6).
5. Install two wires L2 (9) on CB1 (4) with lockwasher (7) and nut (6).
6. Install four wires L3 (8) on CB1 (4) with lockwasher (7) and nut (6).



EVAC620X02

CB1 Installation - Continued

7. Install CB1 (4) in A/C body (5) with six lockwashers (3), washers (2), and screws (1).



CB2 Removal

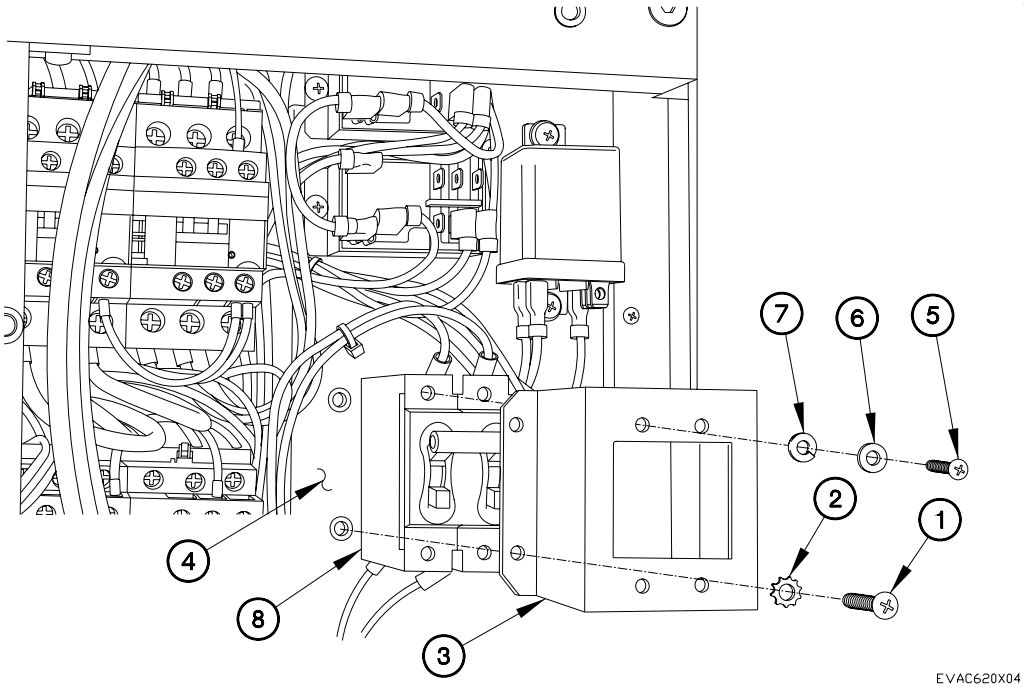
NOTE

Refer to Table 2 Circuit Breaker CB2 Terminal Connection Wires

Table 2 Circuit Breaker CB2 Terminal Connection Wires

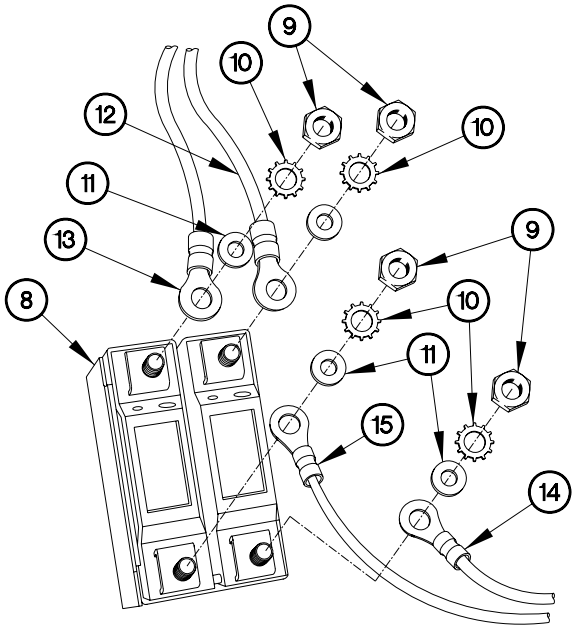
CB2	
L3	L1
L3A	L1A

1. Remove four screws (1), lockwashers (2), and bracket (3) from A/C body (4).
2. Remove four screws (5), washers (6), lockwashers (7), and CB2 (8) from bracket (3).



CB2 Removal - Continued

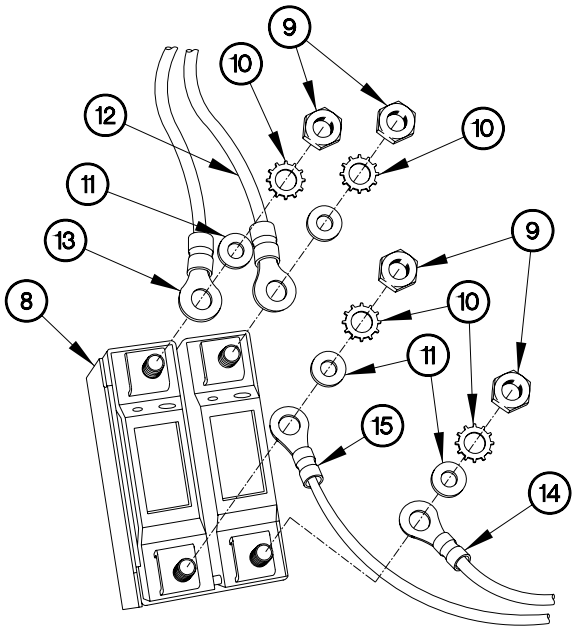
3. Remove four nuts (9), lockwashers (10), washers (11), and wires L1, L3, L1A, and L3A (12, 13, 14, and 15) from CB2 (8).



EVAC620X05

CB2 Installation

1. Install wires L1, L3, L1A, and L3A (12, 13, 14, and 15) on CB2 (8) with four washers (11), lockwashers (10), and nuts (9).



EVAC620X05

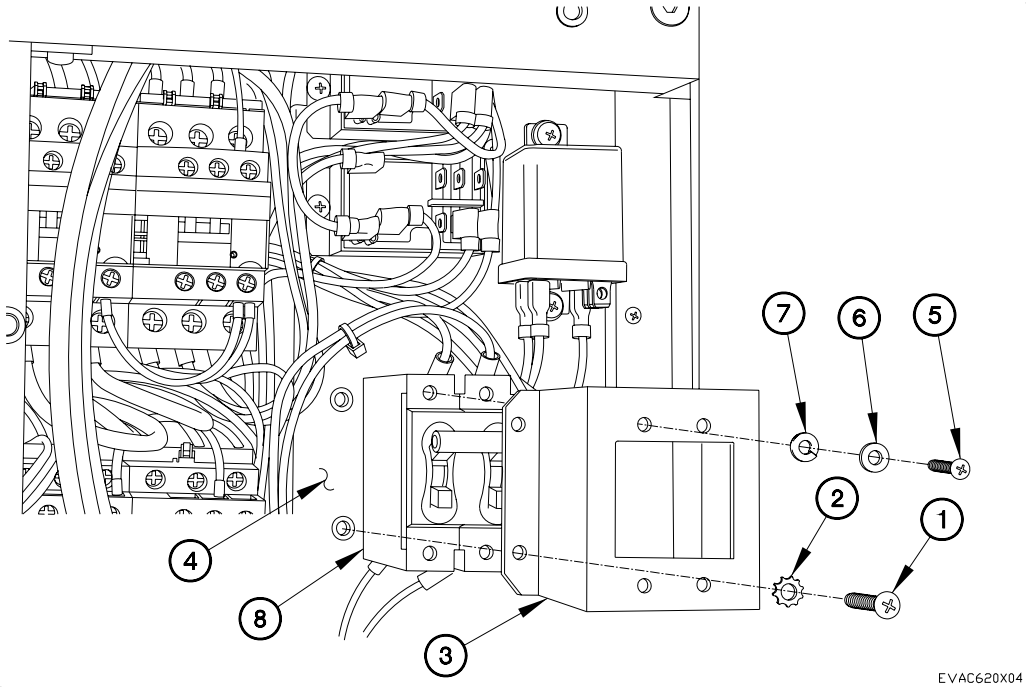
CB2 Installation - Continued

NOTE

Refer to Table 2 Circuit Breaker CB2 Terminal Connection Wires

2. Install CB2 (8) on bracket (3) with four lockwashers (7), washers (6), and screws (5).

3. Install bracket (3) on A/C body (4) with four lockwashers (2) and screws (1).



END OF WORK PACKAGE.

REMOTE CONTROL BOX REPAIR 6.21

THIS WORK PACKAGE COVERS:

INITIAL SETUP:

Maintenance Level
Field

Equipment Conditions
Remote control box removed (392-10)

Tools and Special Tools
Genl Mech Tool Kit (NSN 5180-01-454-3787)

Tools and Special Tools (Cont)
Tool Kit, Electrical (NSN 5180-00-876-9336)

Follow-On Mainenance
Install remote control box (392-10)
Operate A/C, checking for proper Operation (Chapter 5)

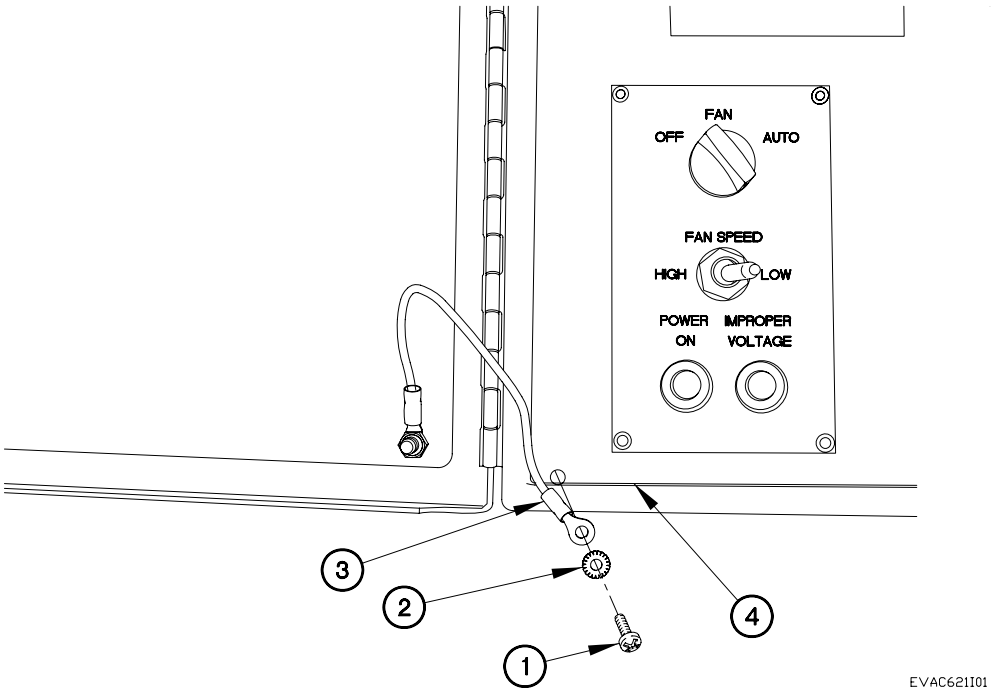
Parts Figure
Figure 230-00018-A12

Disassembly

NOTE

Tag wires and connection points prior to disconnection.

1. Remove four screws (1), washers (2), and ground wire (3) from front panel (4).

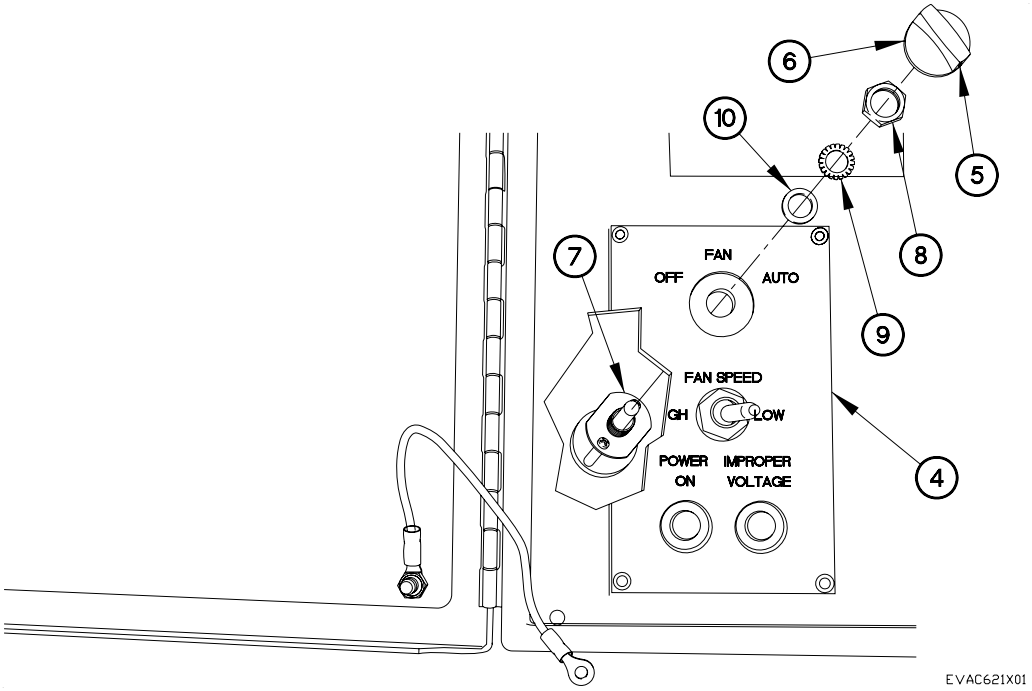


Disassembly - Continued

2. Loosen screw (5) on knob (6).

3. Remove knob (6) from selector switch (7).

4. Remove nut (8), lockwasher (9), washer (10), and selector switch (7) from front panel (4).



Disassembly - Continued

NOTE

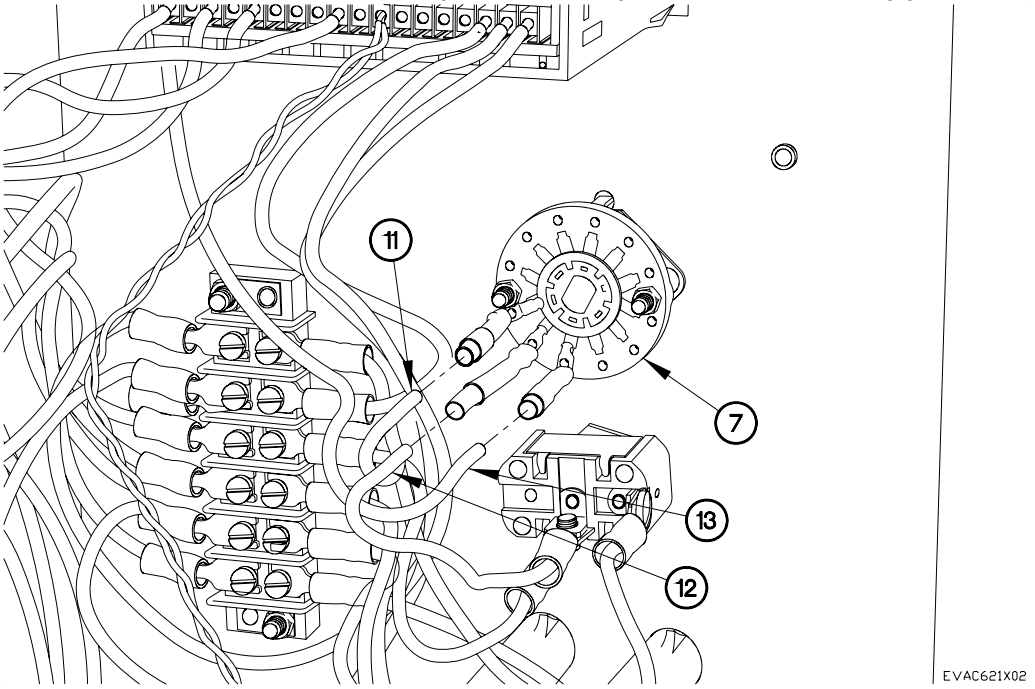
Tag wires and connection points prior to disconnection.

Refer to Table 1 Selector Switch Terminal Connection Wires

Table 1 Selector Switch Terminal Connection Wires

Selector Switch		
250	252	251

5. Cut wires 250, 252, and 251 (11, 12, and 13) from selector switch (7).



Disassembly - Continued

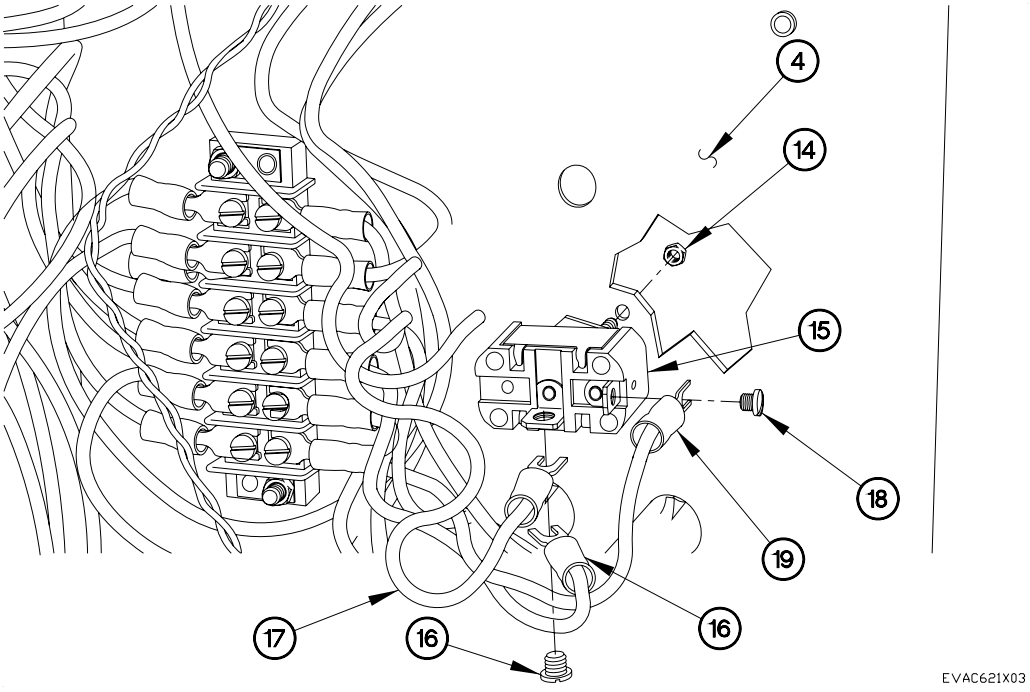
NOTE

Refer to Table 2 Toggle Switch Terminal Connection Wires

Table 2 Toggle SwitchTerminal Connection Wires

Toggle Switch	
252 (X2)	258

6. Remove nut (14) and toggle switch (15) from front panel (4).
7. Remove screw (16) and two wires 252 (17) from toggle switch (15).
8. Remove screw (18) and wire 258 (19) from toggle switch (15).



Disassembly - Continued

NOTE

Refer to Table 3 Terminal Board Connection Wires

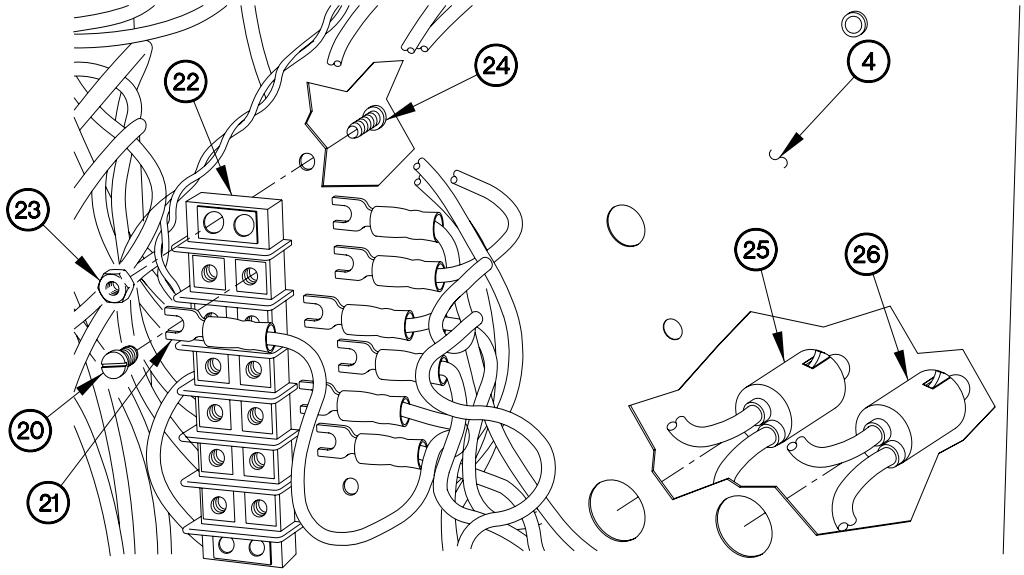
Table 3 Terminal Board Connection Wires

250 (X2)	250 (X2)
Green (X2)	Green
252	252
256	256
257 (X2)	257 (X2)
258	258

9. Remove 12 screws (20) and 17 wires (21) from terminal board (22).

10. Remove two self-locking nuts (23), screws (24), and terminal board (22) from front panel (4).

11. Remove indicator lights (25 and 26) from front panel (4).



EVAC621X04

Disassembly - Continued

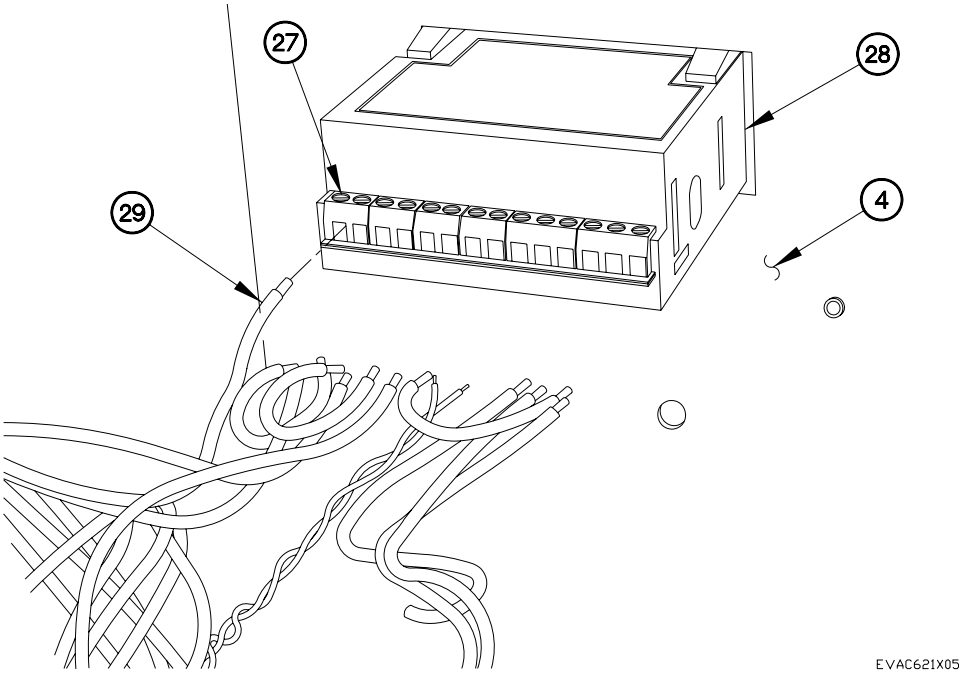
NOTE

Refer to Table 4 Thermostat Connection Wires

Table 4 Thermostat Connection Wires

Heat	Com	Cool	Com	Timer Out	Com	Timer In	Com	Sensor WH	Sensor BK		GND	24V	Com
253	251(2)	254	251 257	260	257	259	251	W	B	N/A	Grn	250	251 257

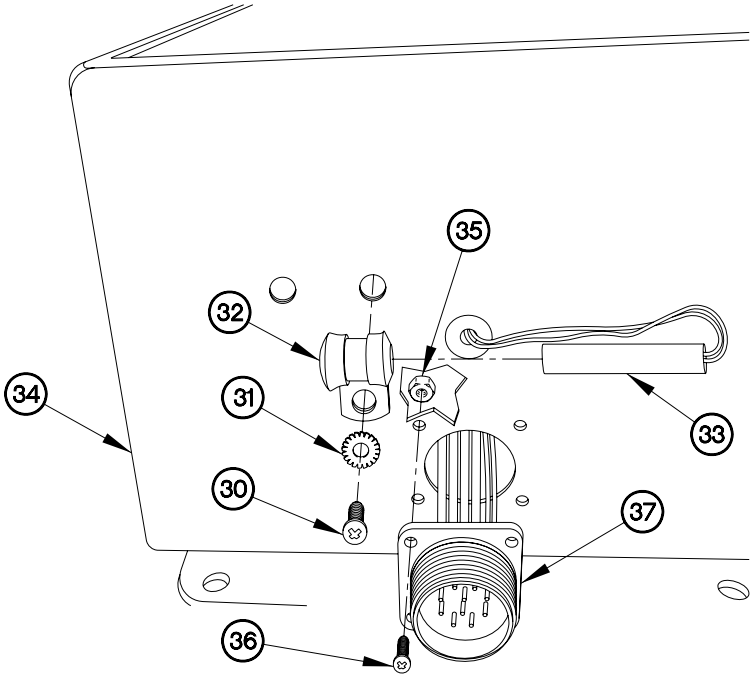
12. Loosen 14 screws (27) on thermostat (28).
13. Remove 16 wires (29) from thermostat (28).
14. Remove thermostat (28) from front panel (4).



Disassembly - Continued

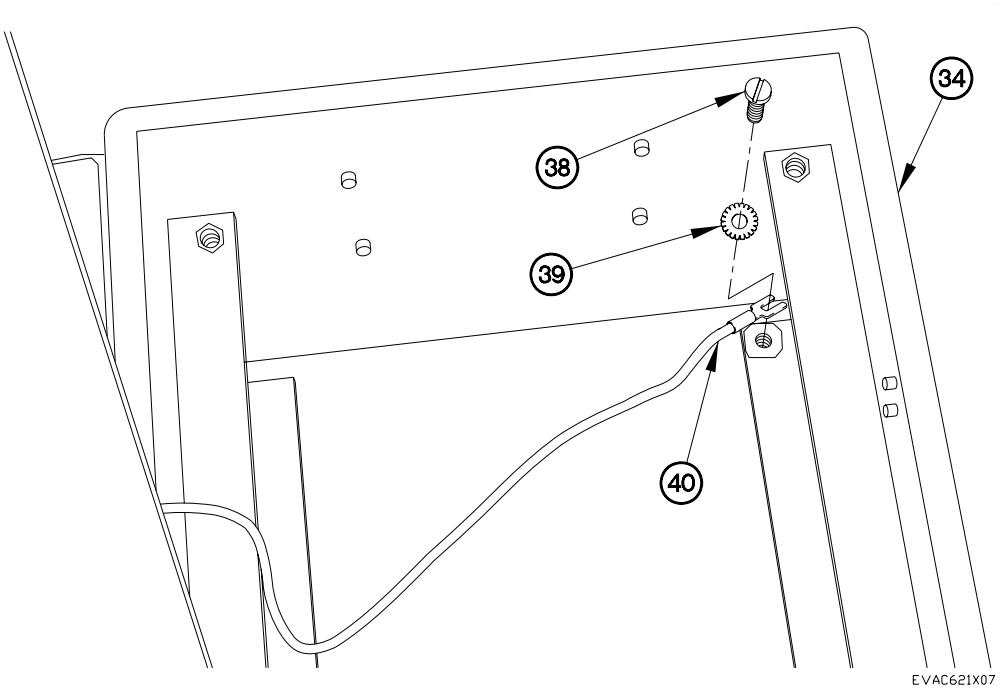
15. Remove two screws (30), lockwashers (31), clamps (32), and thermometer (33) from remote control box (34).

16. Remove four self-locking nut (35), screws (36), and connector (37) from remote control box (34).



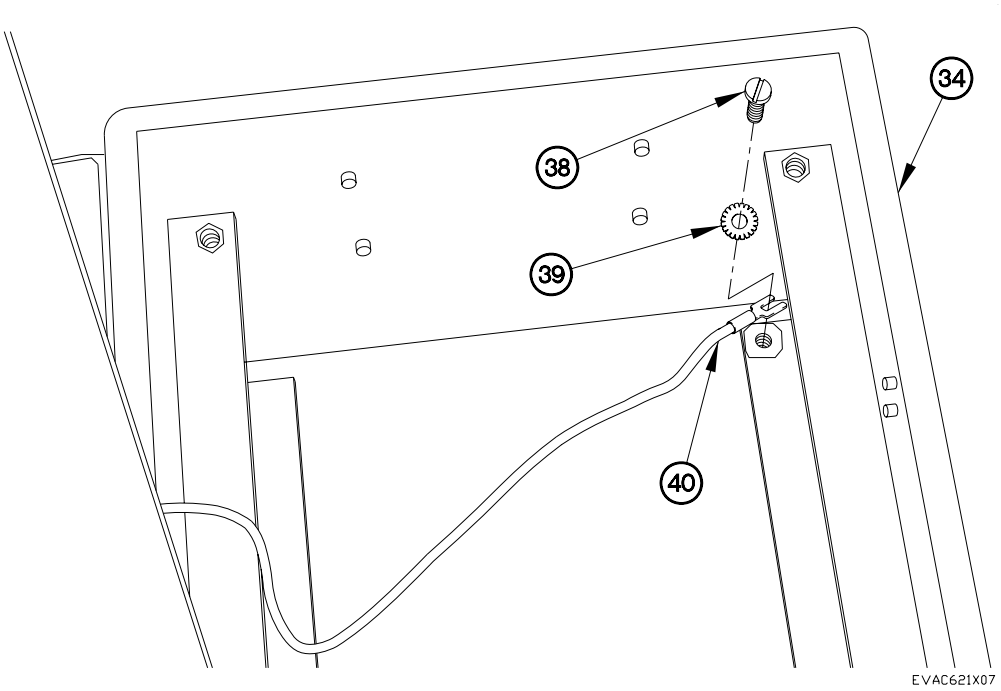
Disassembly - Continued

17. Remove screw (38), lockwasher (39), and ground wire (40) from remote control box (34).



Assembly

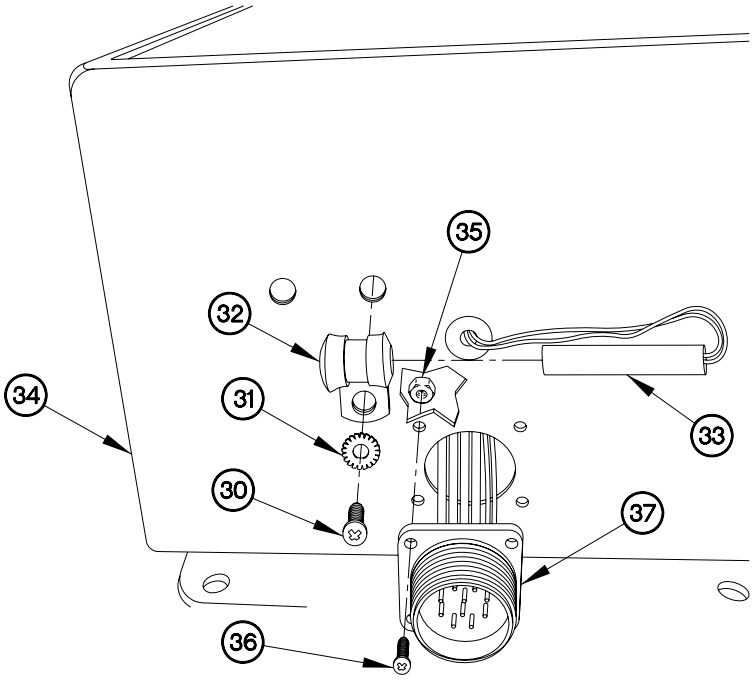
1. Install ground wire (40) on remote control box (34) with lockwasher (39) and screw (38).



Assembly - Continued

2. Install connector (37) in remote control box (34) with four screws (36) and self-locking nuts (35).

3. Install thermometer (33) on remote control box (34) with two clamps (32), lockwashers (31), and screws (30).

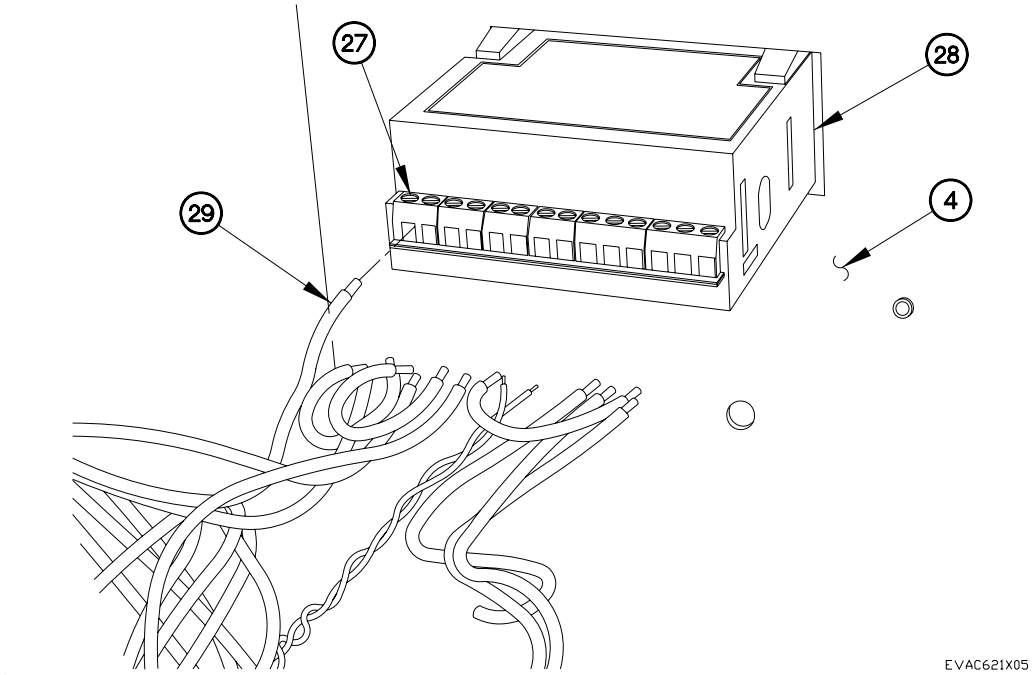


Assembly - Continued

NOTE

Refer to Table 4 Thermostat Connection Wires

4. Install thermostat (28) in front panel (4).
5. Install 16 wires (29) in thermostat (28).
6. Tighten 14 screws (27) on thermostat (28).



Assembly - Continued

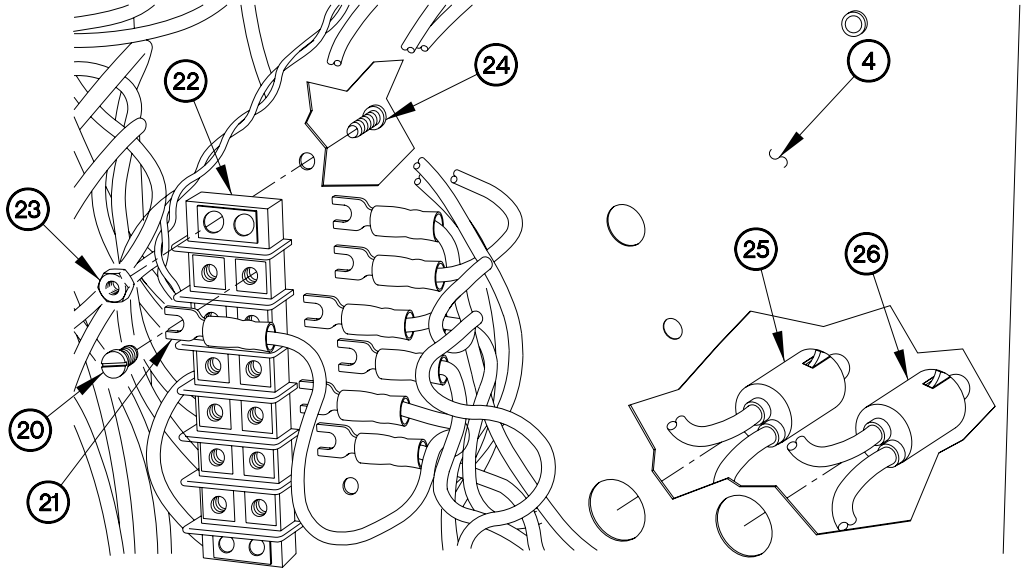
NOTE

Refer to Table 3 Terminal Board Connection Wires

7. Install indicator lights (25 and 26) in front panel (4).

8. Install terminal board (22) on front panel (4) with two screws (24) and self-locking nuts (23).

9. Install 17 wires (21) on terminal board (22) with 12 screws (20).



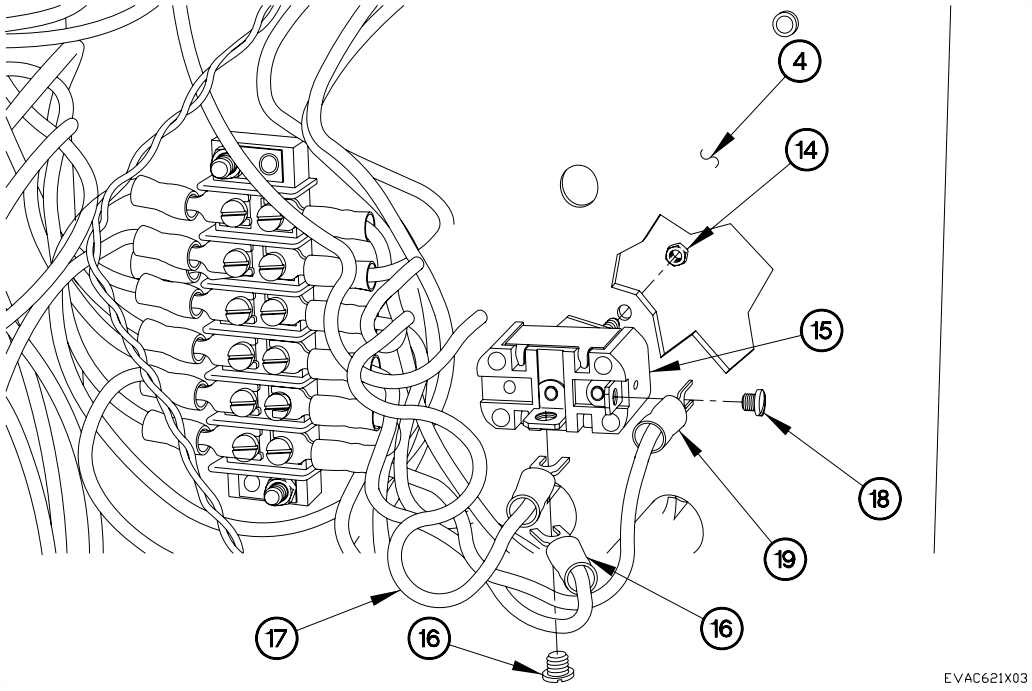
EVAC621X04

Assembly - Continued

NOTE

Refer to Table 2 Toggle Switch Terminal Connection Wires

10. Install wire 258 (19) on toggle switch (15) with screw (18).
11. Install two wires 252 (17) on toggle switch (15) with screw (16).
12. Install toggle switch (15) in front panel (4) with nut (14).

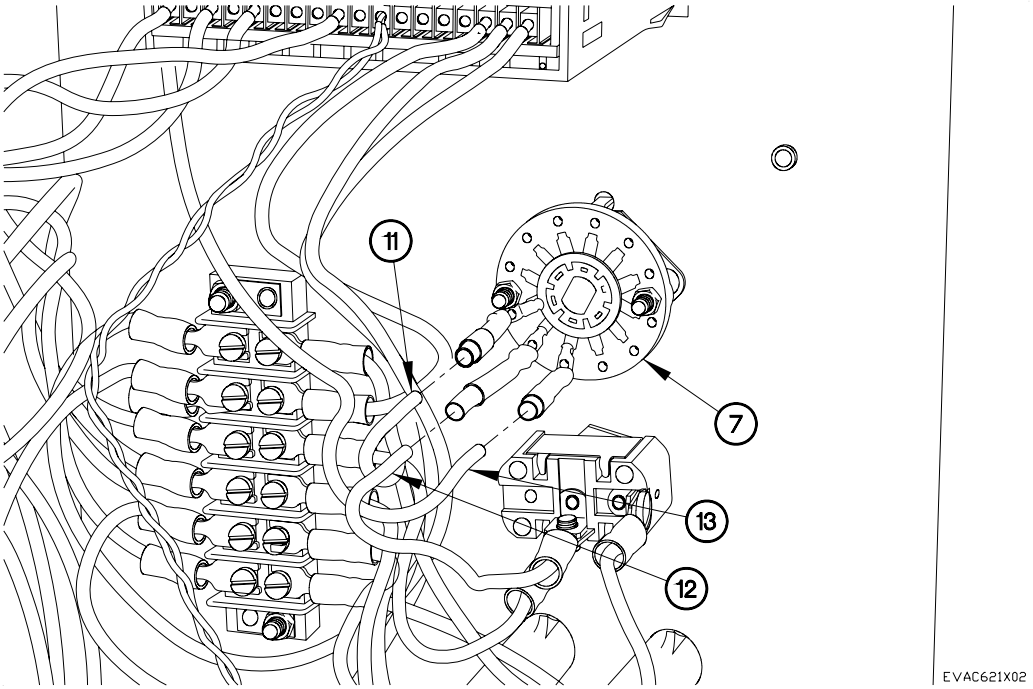


Assembly - Continued

NOTE

Refer to Table 1 Selector Switch Terminal Connection Wires

13. Install wires 250, 252, and 251 (11, 12, and 13) on selector switch (7).

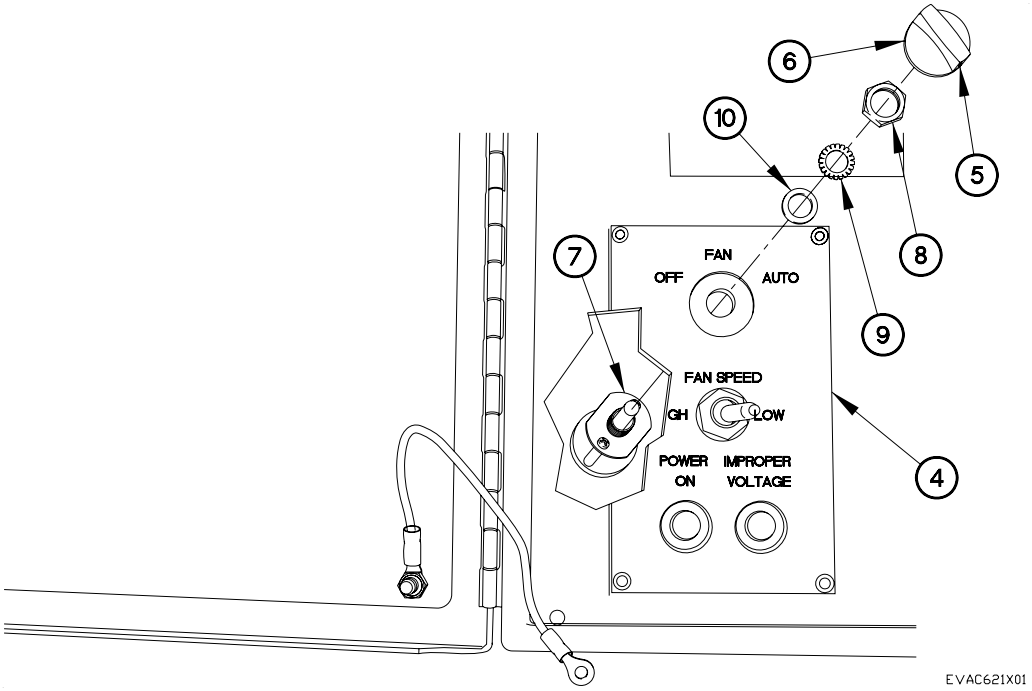


Assembly - Continued

14. Install selector switch (7) on front panel (4) with washer (10), lockwasher (9), and nut (8).

15. Install knob (6) on selector switch (7).

16. Tighten screw (5) on knob (6).



END OF WORK PACKAGE.

AIR CONDITIONER REPLACEMENT 6.22

THIS WORK PACKAGE COVERS:

INITIAL SETUP:
- Engine shut down (392-10)
- Air conditioner panels removed (392-10)
- Van body sides expanded approximately 12 in. each (392-10)
- LH and RH doors opened (115 degrees) (392-10)

Maintenance Level
- Field

Tools and Special Tools
- Genl MechTool Kit (NSN 5180-01-454-3787)
- Sling, Endless (NSN 3940-00-675-5003)
- Helmets (Standard Issue)
- Gloves, Welder's (NSN 8415-00-268-7859)
- Wooden Blocks

Mandatory Replacement
- Gasket, Rubber (2) (24.25 in. (62 cm)) (P/N 12442069-002)
- Gasket, Rubber (2) (30 in. (76 cm)) (P/N 12442069-007)
- Adhesive (NSN 8030-01-435-3473)
- Sealing Compound (NSN 8030-00-204-9149)
- Lockwashers (24) (NSN 5310-00-984-7042)
- Lockwashers (4) (NSN 5310-00582-5965

Personnel Required
- (3)

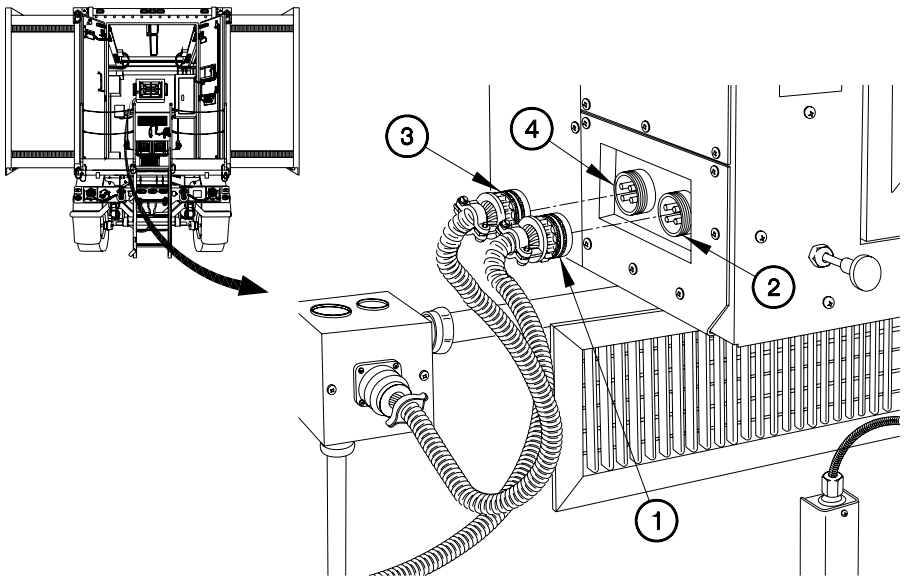
Equipment Conditions
- Operate air conditioner and check for proper operation. (Chapter 5)
- Install air conditioner panels (392-10)
- Close LH and RH doors (392-10)

WARNING

Use extreme caution when stepping, standing, and working on outside of van platform storage area. Failure to comply may result in serious injury to personnel.

Removal

1. Disconnect connector P513 (1) from connector J513 (2).
2. Disconnect connector J512 (3) from connector P512 (4).

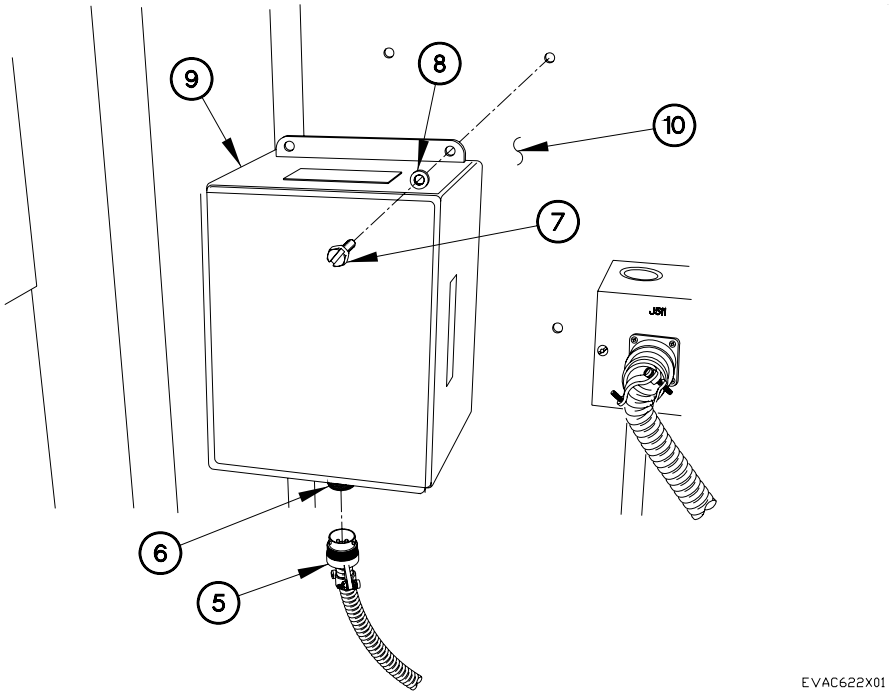


EVAC622R01

Removal - Continued

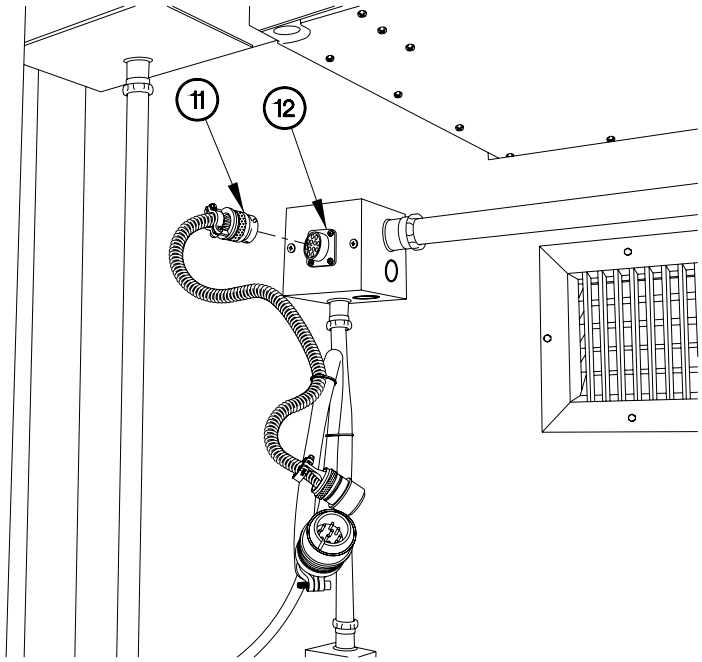
3. Disconnect connector J514 (5) from connector P514 (6).

4. Remove four screws (7) and washers (8) from air conditioner control box (9) from van body wall (10).



Removal - Continued

5. Disconnect connector P511 (11) from connector J511 (12).

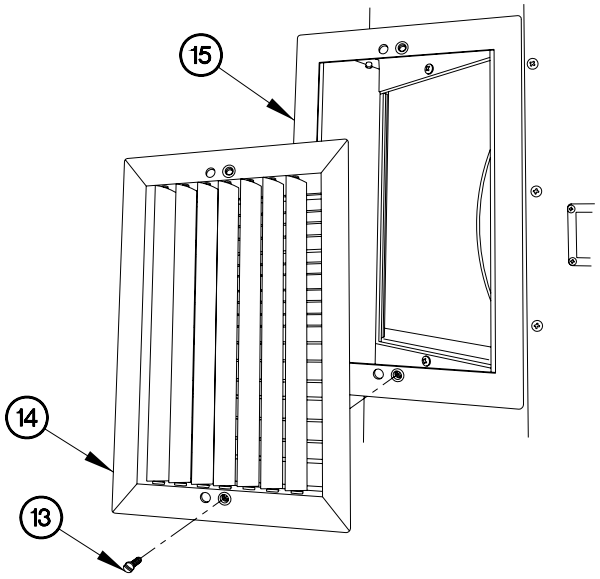


Removal - Continued

NOTE

Top, LH, and RH vent housings are removed from A/C unit the same way. LH side shown.

6. Remove two screws (13) and vent cover (14) from vent housing (15).

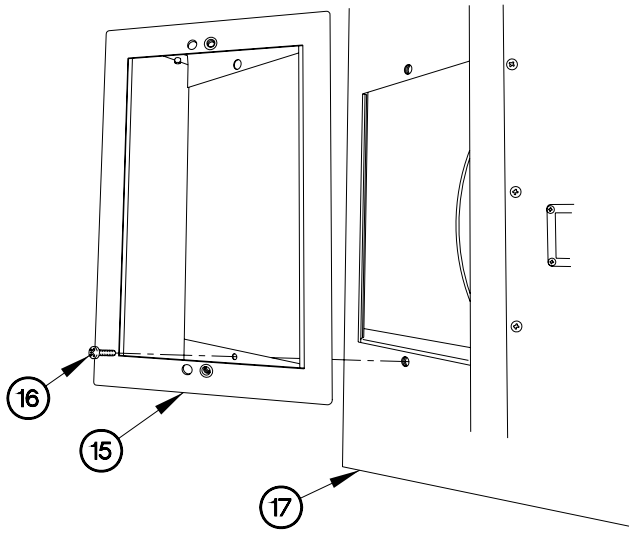


EVAC622X03

Removal - Continued

7. Remove two screws (16) and vent housing (15) from A/C unit (17).

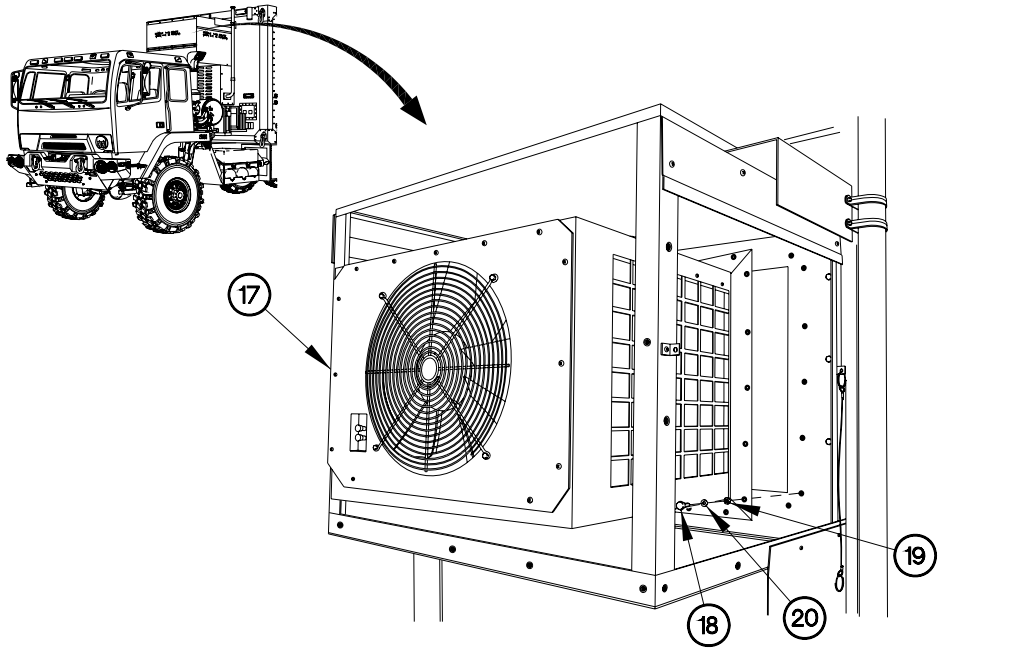
8. Perform previous two steps on remaining vent housings.



EVAC622X04

Removal - Continued

9. Remove 24 bolts (18), washers (19), and lockwashers (20) from A/C unit (17). Discard lockwashers.

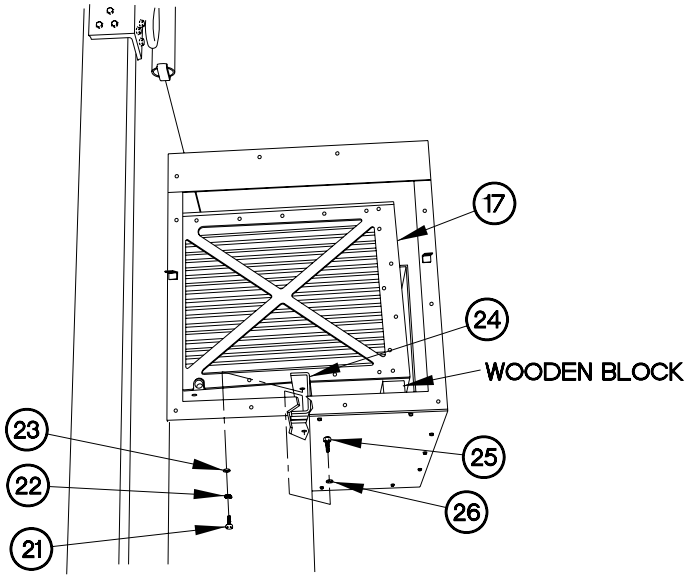


Removal - Continued

10. Position wooden blocks underneath front of A/C unit (17).

11. Remove four screws (21), lockwashers (22), and washers (23) from C-channel (24) and A/C unit (17). Discard lockwashers.

12. Remove two screws (25) and washers (26) from C-channel (24).



EVAC622X06A

Removal - Continued

13. Wrap endless sling between van body wall (10) and C-channel (24) as shown.

WARNING

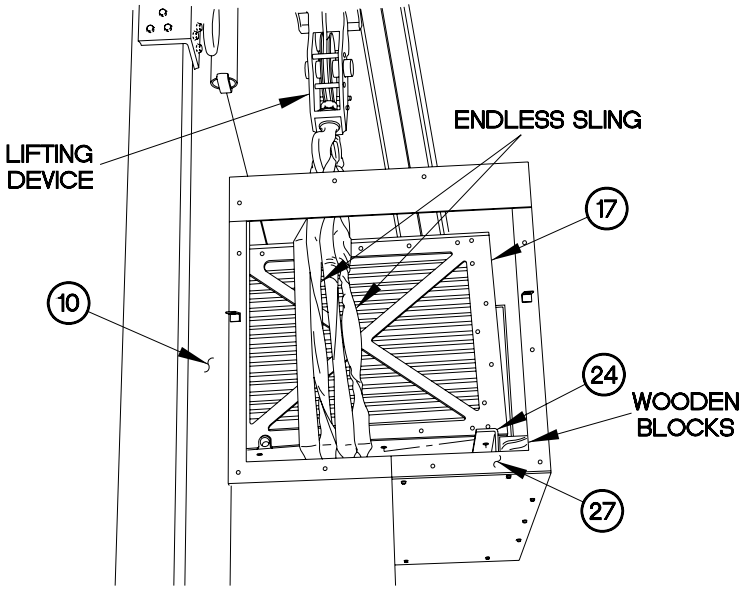
A/C unit weighs approximately 400 lbs (181 kgs). Attach lifting device to endless slings. Wear appropriate hard hats as required when working underneath lifting device and around A/C unit. Failure to comply may result in serious injury or death to personnel or damage to equipment.

NOTE

Raise A/C unit only enough to release pressure from C-channel. Failure to comply may result in damage to equipment.

14. Lift A/C unit (17) until C-channel (24) is loose.

15. Reposition C-channel (24) to forward section of frame (27), as shown.



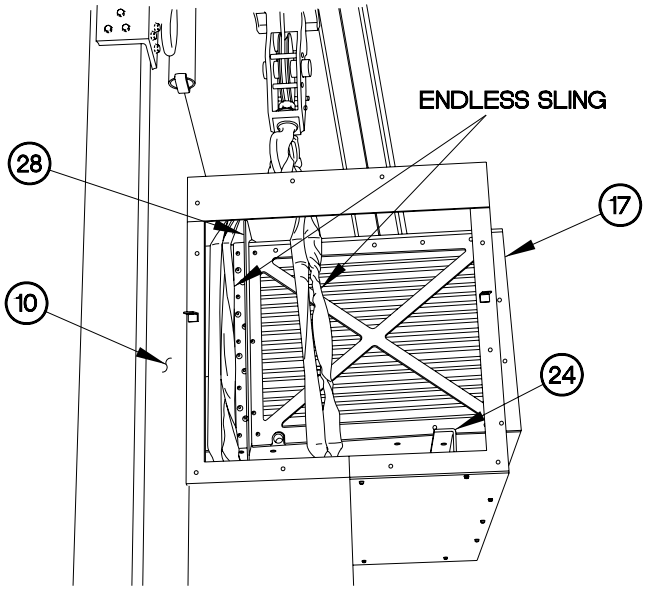
EVAC622X07

Removal - Continued

NOTE

Move A/C unit away from van body approximately 6 in. (15 cm).

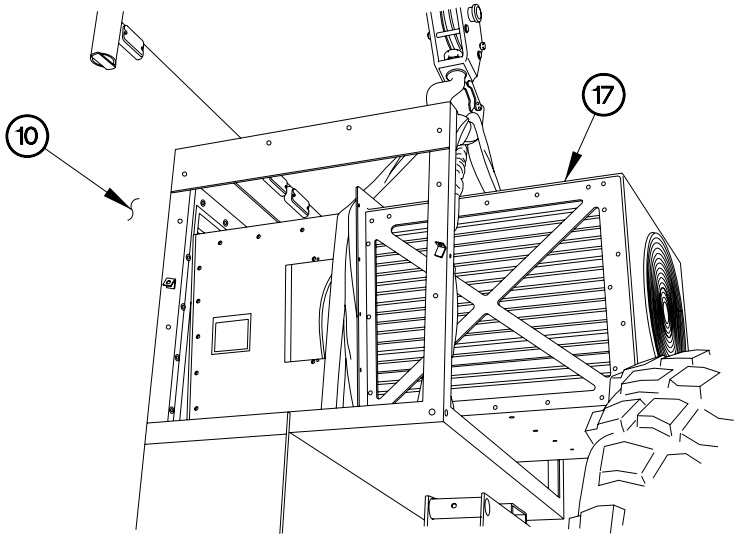
16. Move A/C unit (17) away from van body wall (10).
17. Lower A/C unit (17) on C-channel (24).
18. Position one end of endless sling on other side of flange (28).



EVAC622R02

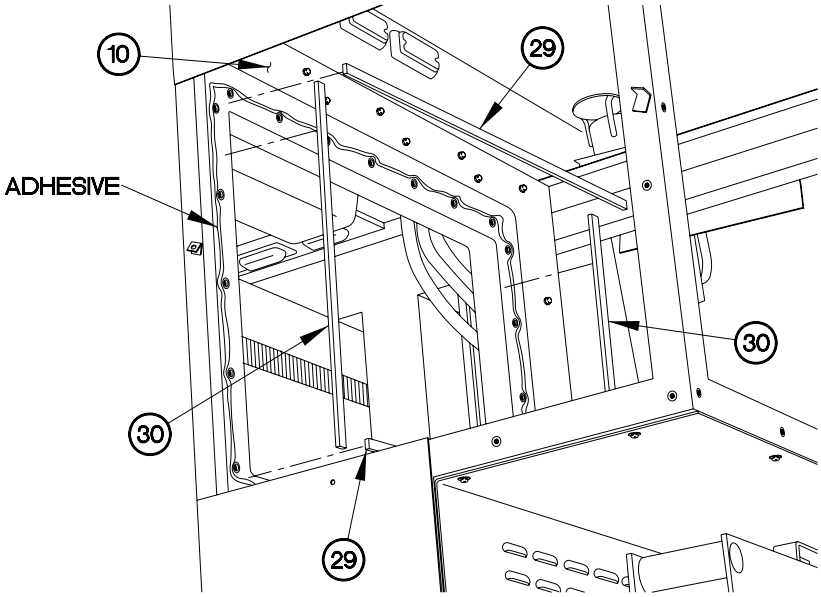
Removal - Continued

19. Remove A/C unit (17) from van body wall (10).



EVAC622X08

20. Remove adhesive and two gaskets (29 and 30) from surface of van body wall (10).

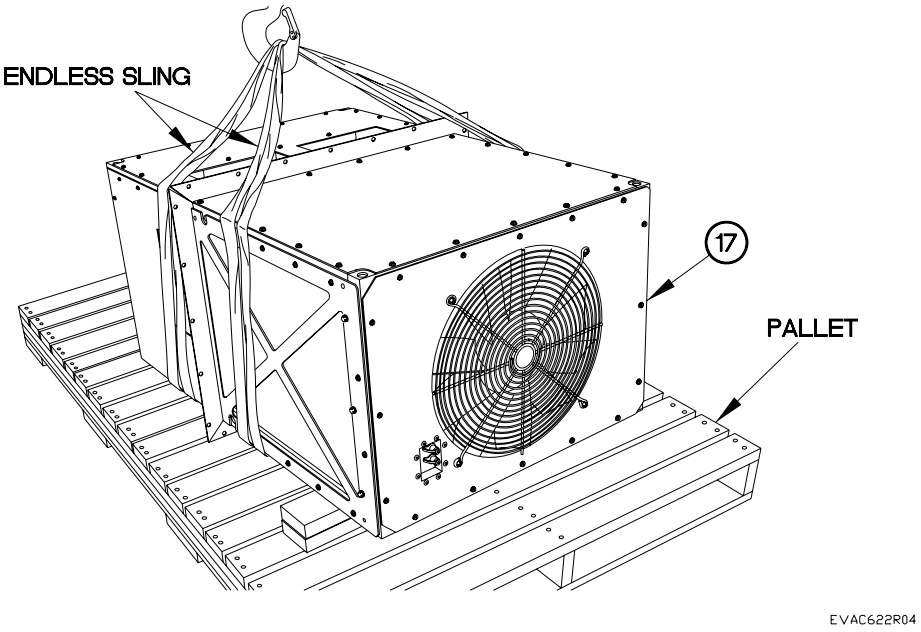


EVAC622I02

Removal - Continued

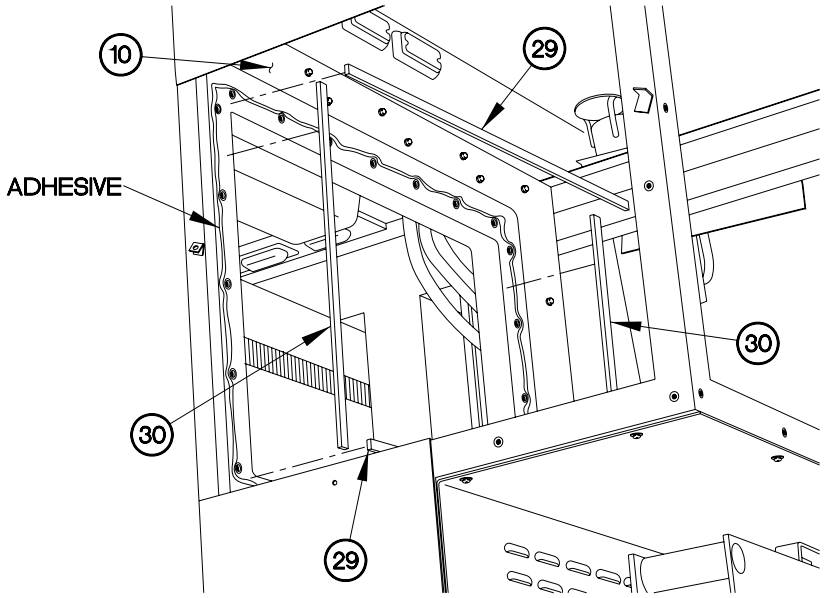
21. Position A/C unit (17) on pallet.

22. Remove endless sling from A/C unit (17).



Installation

1. Apply adhesive to surface of van body wall (10).
2. Install two gaskets (29 and 30) on van body wall (10).



EVAC622102

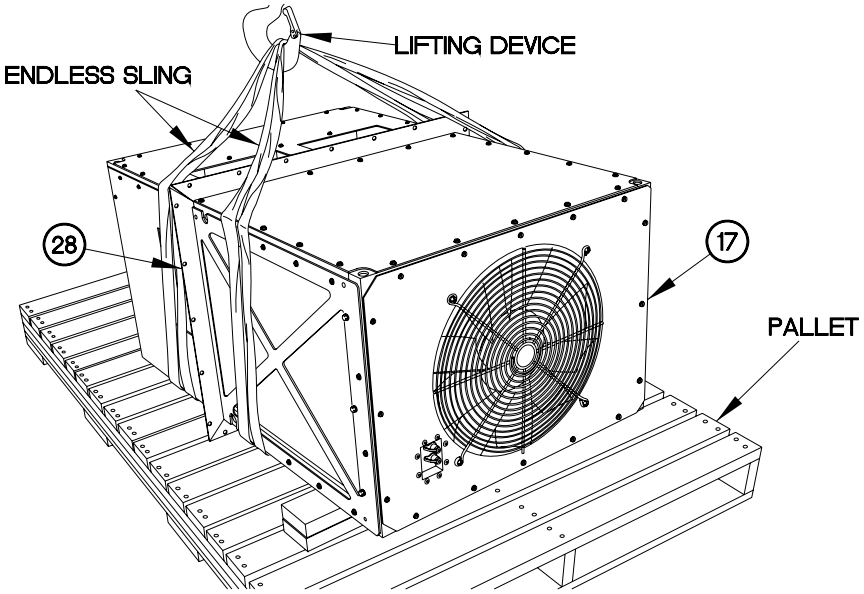
Installation - Continued

WARNING

A/C unit weighs approximately 400 lbs (181 kgs). Attach lifting device to endless slings. Wear appropriate hard hats as required when working underneath lifting device and around A/C unit. Failure to comply may result in serious injury or death to personnel or damage to equipment.

3. Position endless sling on both sides of flange (28) on A/C unit (17).

4. Raise A/C unit (17).



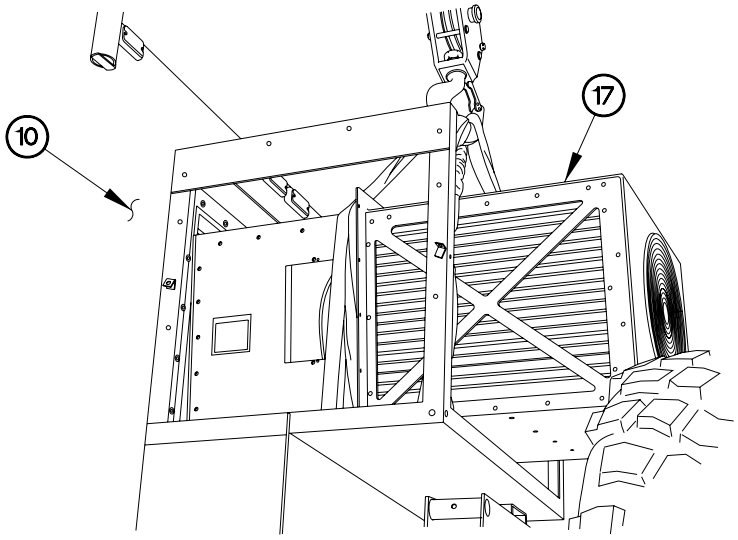
EVAC622103

Installation - Continued

NOTE

Install A/C unit into van body until flange is approximately 6 in. (15 cm) away from van body wall.

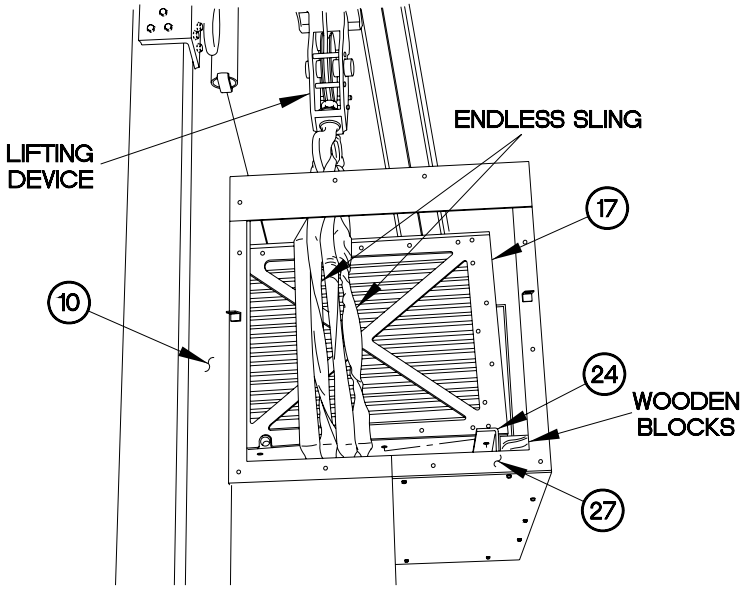
5. Position A/C unit (17) in van body wall (10).



EVAC622X08

Installation - Continued

6. Position wooden blocks underneath front of A/C unit (17).
7. Position C-channel (24) to forward section of frame (27).
8. Lower A/C unit (17) on C-channel (24).
9. Reposition endless sling on forward side of A/C unit (17).
10. Raise A/C unit (17) off of C-channel (24).
11. Slide A/C unit (17) into van body wall (10).
12. Reposition endless sling to rear of A/C unit (17).



EVAC622X07

Installation - Continued

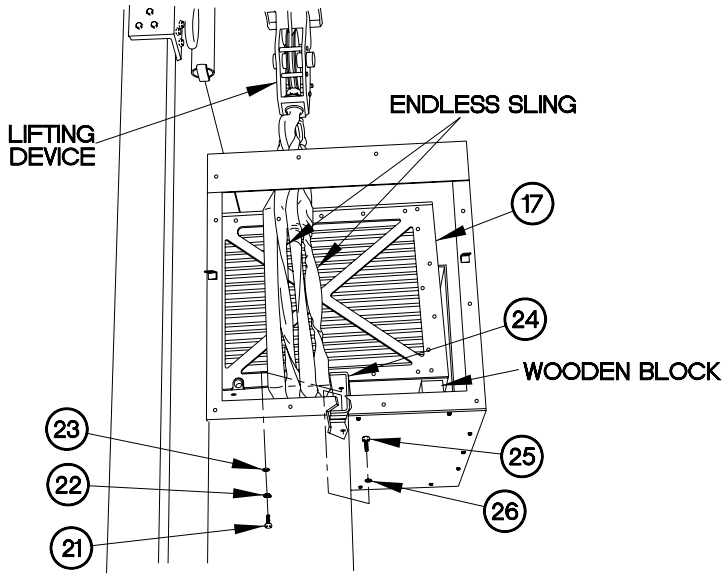
13. Apply sealing compound to threads of four screws (21) and two screws (25).

14. Install C-channel (24) on A/C unit (17) with four washers (23), lockwashers (22), and screws (21).

15. Remove wooden blocks from underneath A/C unit (17).

16. Lower A/C unit (17) on C-channel (24).

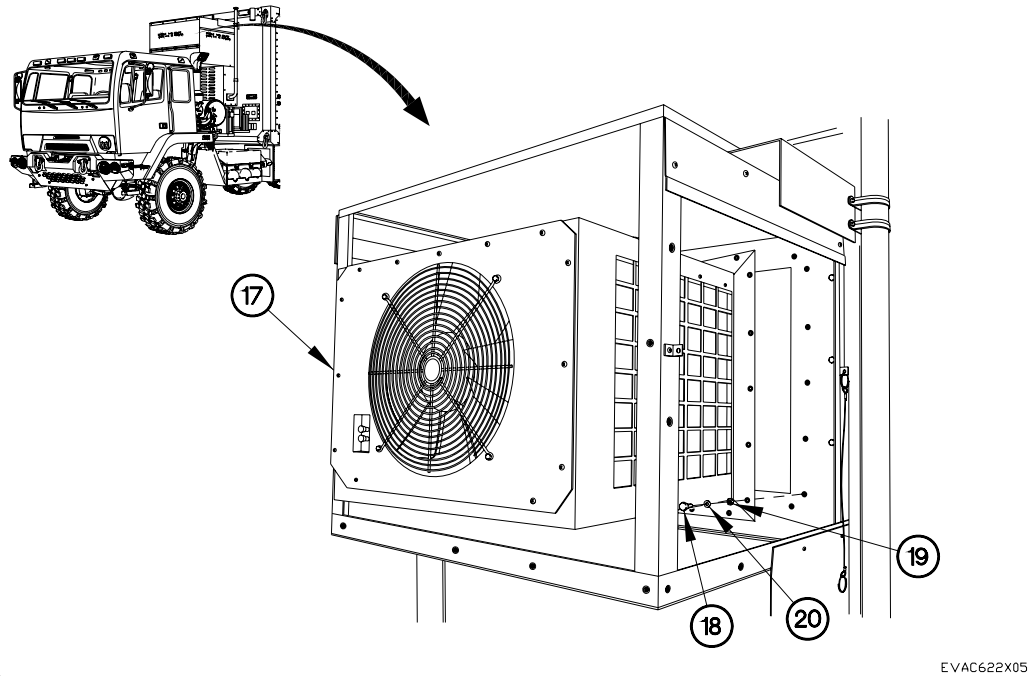
17. Install two washers (26) and screws (25) in C-channel (24).



EVAC622X06

Installation - Continued

18. Install 24 lockwashers (20), washers (19), and bolts (18) in A/C unit (17).

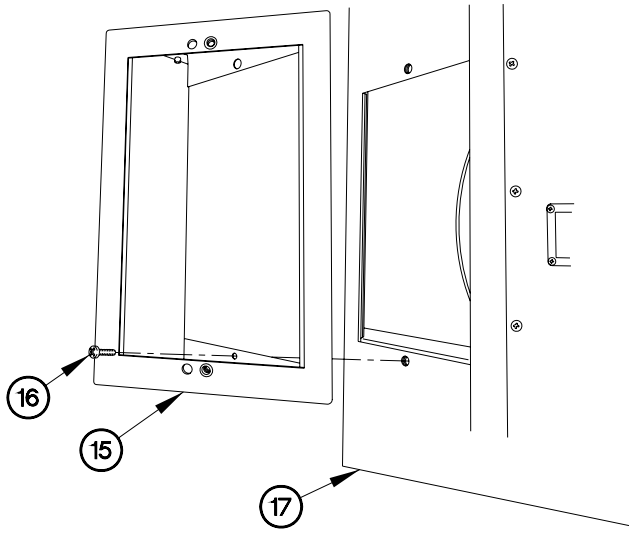


Installation - Continued

NOTE

Top, LH, and RH vent housings are installed on A/C unit the same way. LH side shown.

19. Install vent housing (15) on A/C unit (17) with two screws (16).

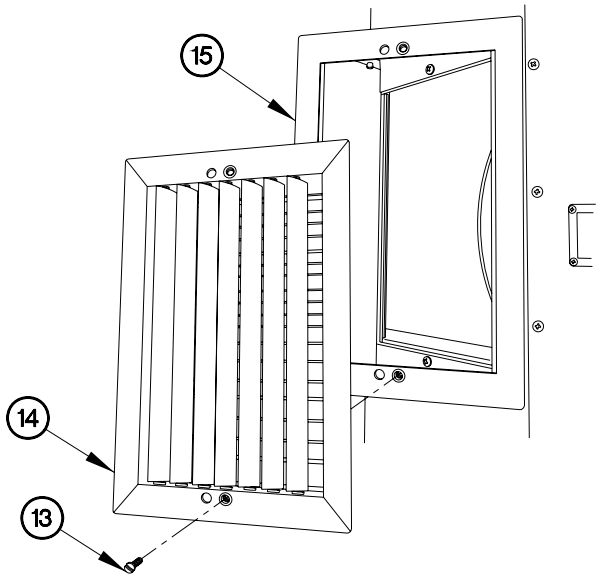


EVAC622X04

Installation - Continued

20. Install vent cover (14) on vent housing (15) with two screws (13).

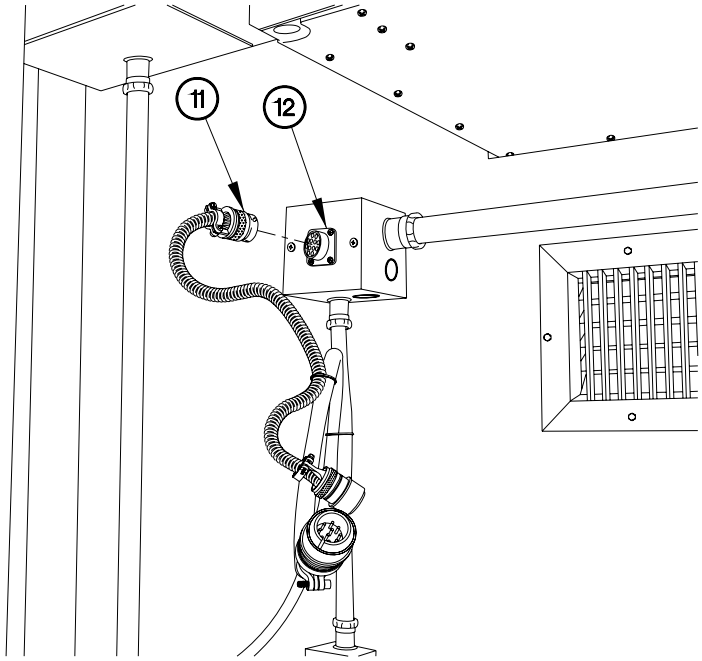
21. Perform previous two steps on remaining vent housings.



EVAC622X03

Installation - Continued

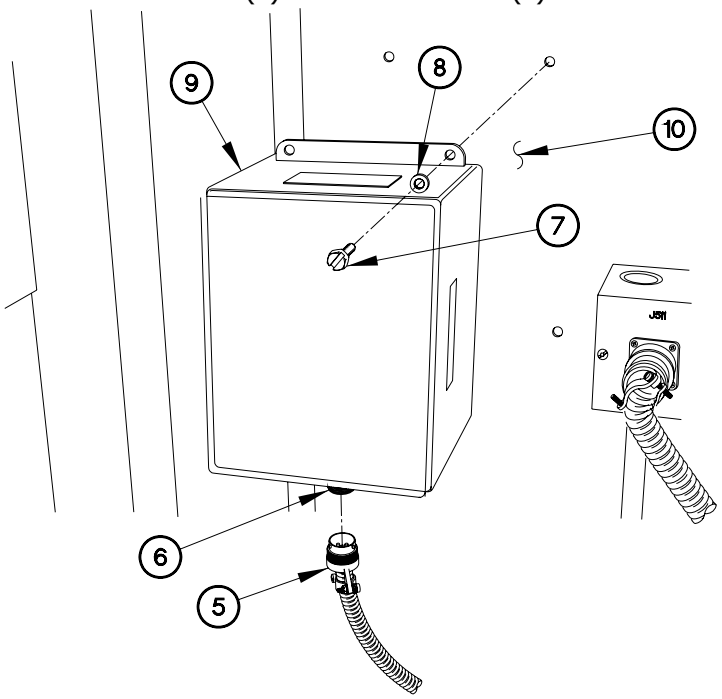
22. Connect connector P511 (11) to connector J511 (12).



Installation - Continued

23. Install air conditioner control box (9) on van body wall (10) with four washers (8) and screws (7).

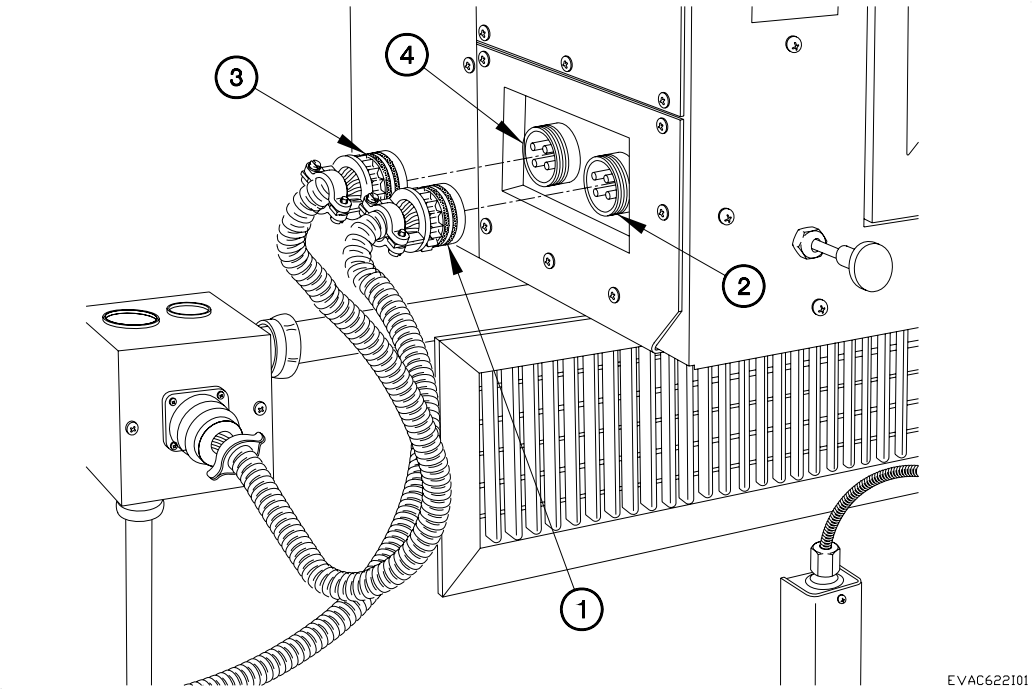
24. Connect connector J514 (5) to connector P514 (6).



Installation - Continued

25. Connect connector J512 (3) to connector P512 (4).

26. Connect connector P513 (1) to connector J513 (2).



END OF WORK PACKAGE.

PHASE MONITOR REPLACEMENT 6.23

THIS WORK PACKAGE COVERS:

INITIAL SETUP:

Maintenance Level
Field

Equipment Conditions
Engine shut down
Generator disconnected
Sides expanded/platform installed (392-10)
Panel(s) removed (para 6.24)

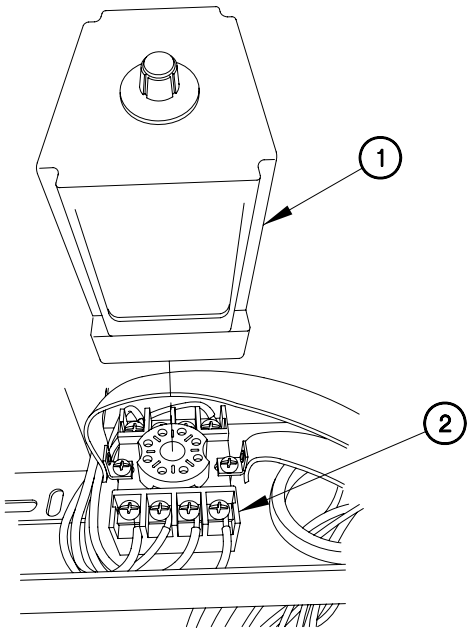
Tools and Special Tools
Genl Mech Tool Kit (NSN 5180-01-454-3787)

Follow-On Mainenance
Connect generator
Operate A/C, checking for proper operation (Chapter 5).
Install panel(s) (para 6.24)
Stow platform/compress sides (392-10)

Parts Figure
Figure 230-00018-A4

Removal

1. Remove phase monitor (1) from base (2).



EVAC623X01

Removal - Continued

NOTE

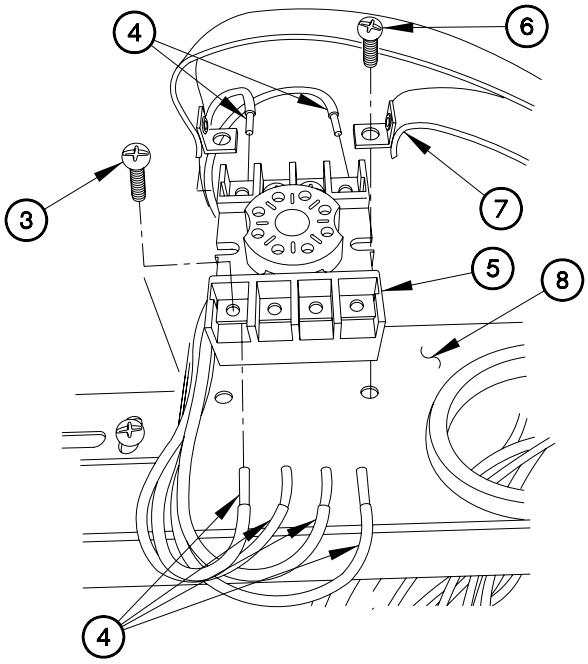
Tag wires and connection points prior to disconnection.

Refer to Table 1 Phase Monitor Base Terminal Connection Wires

Table 1 Phase Monitor Base Terminal Connection Wires

L1	Blank	Blank	203
L2	L3	202	202

2. Remove six screws (3) and wires (4) from phase monitor base (5).
3. Remove two screws (6), strap (7), and phase monitor base (5) from A/C body (8).



EVAC623X02

Installation

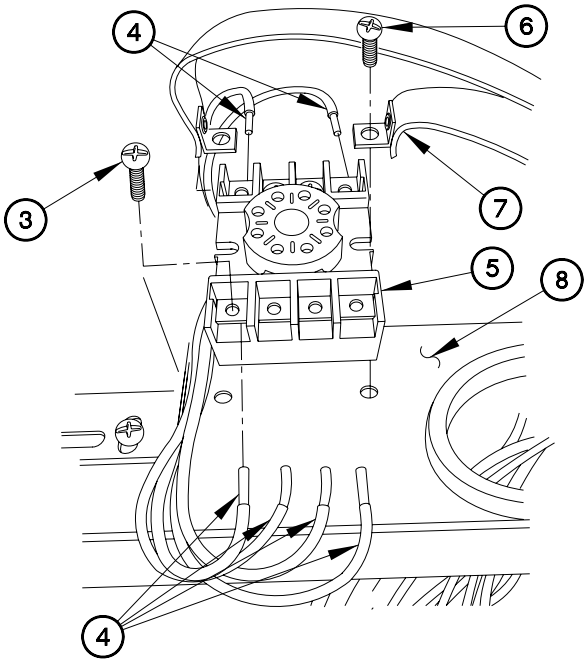
NOTE

Tag wires and connection points prior to disconnection.

Refer to Table 1 Phase Monitor Base Terminal Connection Wires

1. Install phase monitor base (5) on A/C body (8) with strap (7) and two screws (6).

2. Install six wires (4) on phase monitor base (5) with six screws (3).



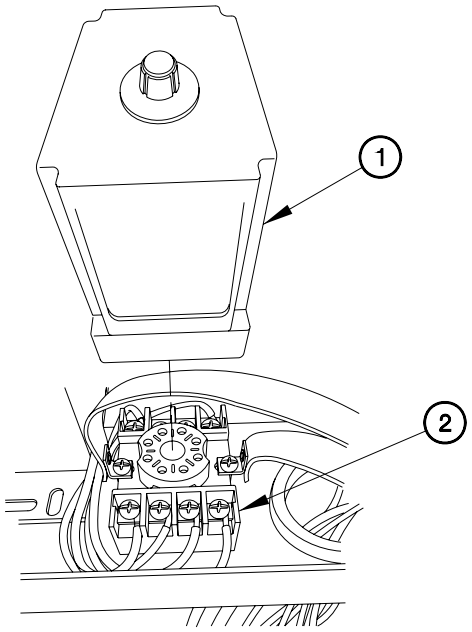
EVAC623X02

Installation - Continued

CAUTION

Phase monitor knob should be set to 75%. Running the ECU with improper phasing can cause severe compressor and prop fan damage. Failure to comply may result in damage to equipment.

3. Install phase monitor (1) in base (2).



EVAC623X01

END OF WORK PACKAGE.

PANELS REPLACEMENT 6.24

THIS WORK PACKAGE COVERS:

INITIAL SETUP:

Maintenance Level
Field

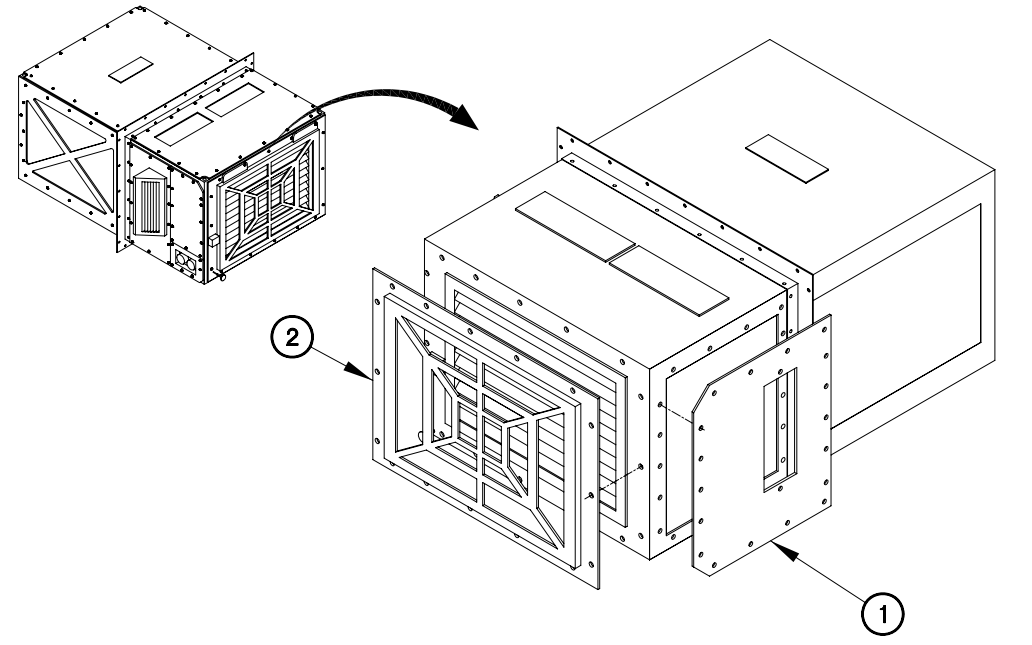
Equipment Conditions
Engine shut down

Tools and Special Tools
Genl Mech Tool Kit (NSN 5180-01-454-3787)

Parts Figure
Figure 230-00018-AM

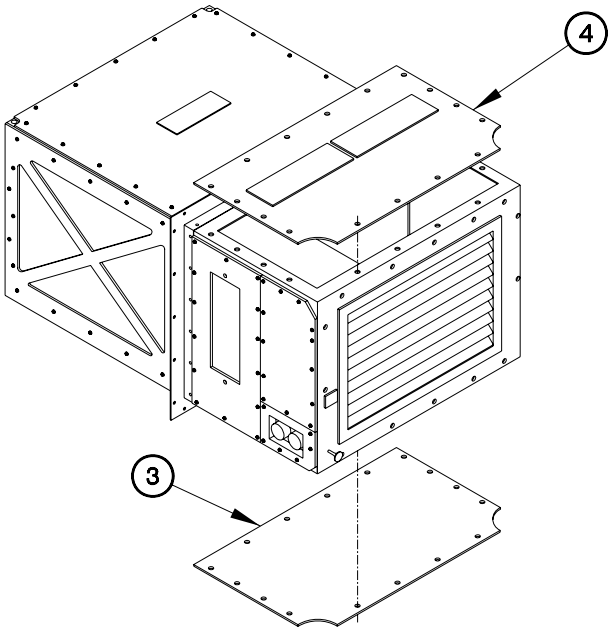
AC Panels Removal

INSIDE AC PANELS	
Panel 1	20 screws
Panel 2	22 screws



AC Panels Removal – Continued

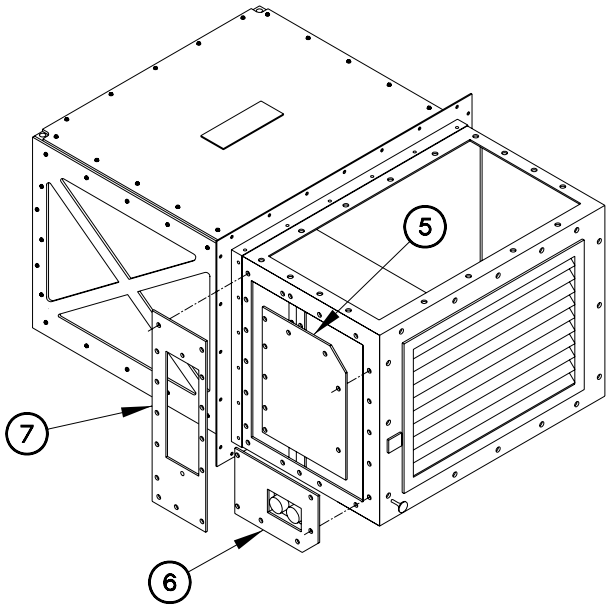
INSIDE AC PANELS	
Panel 3	22 screws
Panel 4	19 screws



EVAC624X01

AC Panels Removal – Continued

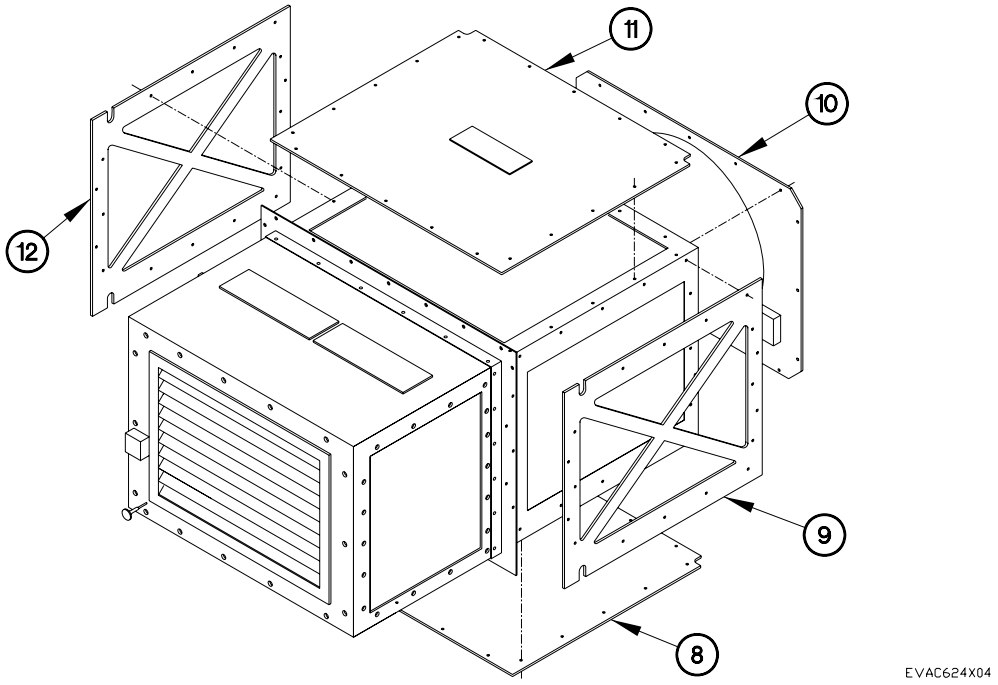
INSIDE AC PANELS	
Panel 5	13 screws
Panel 6	6 screws
Panel 7	14 screws



EVAC624X02

AC Panels Removal – Continued

OUSTSIDE AC PANELS	
Panel 8	25 screws
Panel 9	16 screws
Panel 10	16 screws
Panel 11	19 screws
Panel 12	16 screws



END OF WORK PACKAGE.

BENCH TESTING CONNECTION 6.25

THIS WORK PACKAGE COVERS:

INITIAL SETUP:

Maintenance Level
Field

Tools and Special Tools
Cable, Bench Test (P/N 108-00017-30)

Equipment Conditions
Engine shut down
Remote control box and cable removed from vehicle (para 6.22)

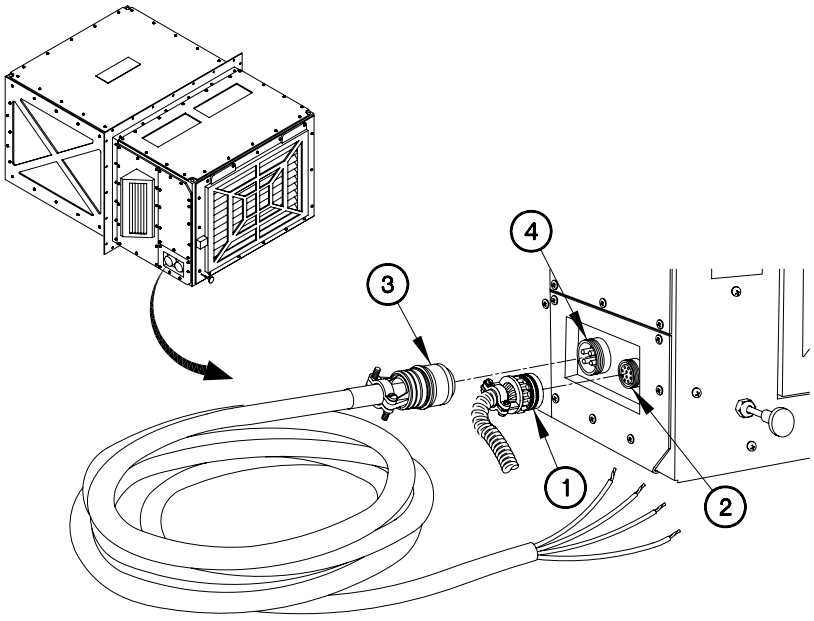
Follow-On Maintenance
Install remote control box and cable in vehicle (para 6.22)

Connection

WARNING

Bench test cable comes with one end that is bare wires for different applications. Attach these wires to the safest configuration available (i.e. circuit breaker panel, 208 3 Phase outlet, generator, etc). Ensure qualified personnel install wires per applicable safety standards. Failure to comply may result in serious injury or death to personnel or damage to equipment.

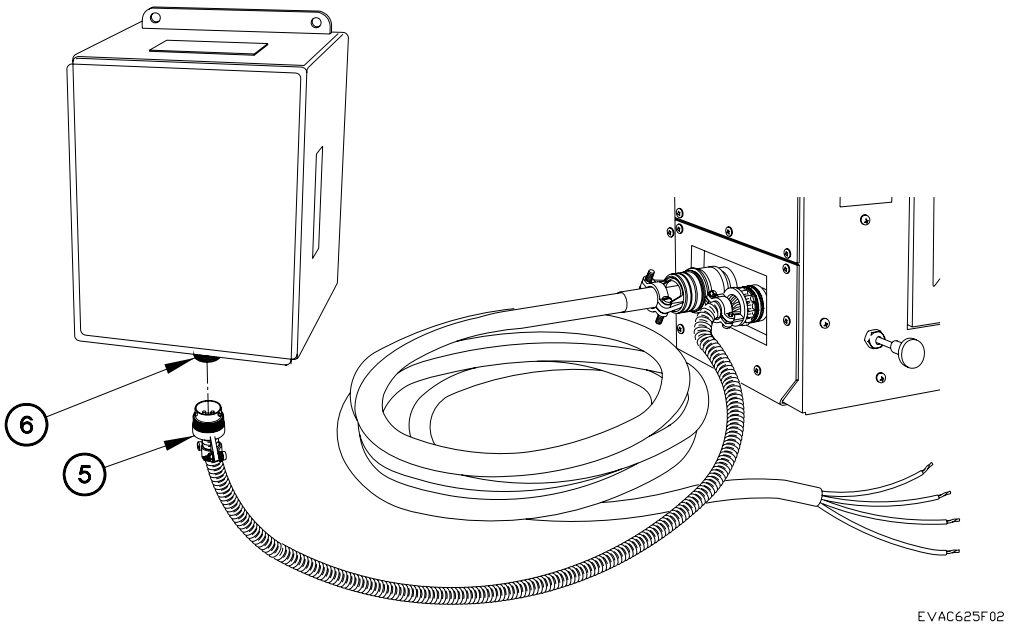
1. Connect connector J512 (1) to connector P512 (2).
2. Connect bench test cable (3) to connector J513 (4).



EVAC625F01

Connection – Continued

3. Connect connector J514 (5) to connector P514 (6).
4. Operate air conditioner (Chapter 5), checking for proper operation.
5. Check for leaks (para 6.26).



END OF WORK PACKAGE.

AIR CONDITIONING LEAK TEST 6.26

THIS WORK PACKAGE COVERS

INITIAL SETUP:

Maintenance Level
Field

Equipment Conditions
A/C removed (para 6.22)
A/C Panels removed (para 6.24)

Tools and Special Tools
Goggles, Industrial (NSN 4240-00-052-3776)

Tools and Special Tools (Cont)
Gloves, Rubber (NSN 8415-00-641-4601)
Tool Kit, Refrigeration (SC 5180-95-N18)
Tool Kit, Gen. Mech. (Item 16, WP 0244 00)

Follow-On Maintenance
Bench test A/C (para 6.25)
Install A/C panels (para 6.24)
Install A/C (para 6.22)

INSPECTION

WARNING

Wear appropriate eye protection and gloves when working on air conditioner system. Failure to comply may result in injury to personnel.

Provide proper ventilation when working with refrigerants. Avoid breathing refrigerant vapors or lubricant mist. Failure to comply may result in injury to personnel.

Use only approved storage tanks for refrigerants. Failure to comply may result in injury to personnel.

Do not use compressed air to test or pressure test a R134a system. Under certain conditions, pressurized mixtures of R134a and air can be combustible. In addition moisture can be injected into the system from shop air. Failure to comply may result in injury to personnel or damage to equipment.

NOTE

Refrigerant is odorless. As a result, all of it may leak away and not be noticed until system stops cooling. All vehicle refrigerant systems lose some refrigerant depending on condition of system. Higher loss rates signal a need to locate and repair leaks.

Leaks are most often found at compressor hose connections and at various fittings and joints in system. If unapproved replacement hoses are installed, refrigerant can be lost through hose permeation.

1. Visually inspect refrigerant system for air conditioning lubricant leakage and corrosion and damage to tubes, hoses, and other components.

INSPECTION - Continued

2. Visually inspect lowest point fittings, hoses, and tubes for indication of lubricant leakage.

TEST

1. Air conditioning system should be charged with a sufficient amount of refrigerant to have gage pressure of at least 50 psi (345kPa) when not in operation. At temperatures below 59 degrees F (15 C) leaks may not be measurable, since this pressure may not be reached.

2. Take care not to contaminate detector probe tip if part being tested is contaminated. If part is particularly dirty, or moisture is present, it should be wiped off with a dry shop towel or blown off with shop air. No cleaners or solvents should be used, since detector may be sensitive to ingredients in cleaner or solvent.

3. Visually trace entire refrigerant system and look for signs of air conditioner lubricant leakage, damage, and corrosion on tubes, hoses, and components. Each questionable area should be carefully checked with detector probe, as well as, all fittings, hoses, service ports with caps in place, and areas around cushion clips and cable ties.

4. Always follow air conditioning system around in a continuous path so that no area of potential leaks are missed. If a leak is found, always continue to test the remainder of the system.

5. At each area checked, probe should be moved around location at a rate of no more than 1 to 2 in./second (3 to 5 CM/second), and no more than ¼ in. (0.64 cm) from surface, completely around position. Slower and closer movement of the probe greatly improves the likelihood of finding a leak. Any increase in beep rate is indicative of a leak.

6. An apparent leak should be verified at least once as follows:

   a) Blow shop air in the area of the suspected leak if necessary, and repeat check the area. In cases of very large leaks, blowing out area with shop air often helps locate the exact position of leak.

   b) Move probe to fresh air and reset. Hold probe as close as possible to leak source and slowly move around it until leak is confirmed.

7. If leaks are indicated, repair leaks as necessary.

END OF WORK PACKAGE

7 Troubleshooting

7.1 General

The following table provides a service technician with a basic guide to troubleshoot common problems with the ECU. While this table is not intended to be all-encompassing, it does list the more common problems that may be encountered along with the possible causes and the suggested remedies.

WARNING!
Troubleshooting must only be performed by qualified technicians.
Serious injury or DEATH can occur.

Table 7.1

Symptom	Possible Cause	Remède
ECU fails to start in Fan Mode	Incorrect voltage (208/3/50-60VAC Required)	Correct voltage to ECU
	Power failure	Check power source, power input and circuit breakers. Check control cables and connections for secure connections
	Correct power connection not selected (phase reversal)	Switch two legs of the 208vac (L1 with L2 at power source.
Compressor fails to start	Defective contactor	Repair or replace, Check for lose wires at contactor and compressor
	Head pressure too high (high-pressure switch open or failed).	Check condenser for blockage, Check condenser fan motor contactor, check high-pressure switch.
	Loss of refrigerant (low pressure switch open)	Repair leak, recharge system, open low-pressure switch.
	Defective short cycle time delay relay in thermostat.	Replace thermostat and return for repair.
	Defective compressor	Replace compressor (See compressor replacement guidelines)

Symptom	Possible Cause	Remède
Noisy compressor	Worn or failed compressor bearings (indicated by excessive knocking)	Replace compressor (See compressor replacement guidelines)
No condenser air flow	Overload trip Defective condenser fan control switch	Determine cause and repair. Replace switch
Head pressure too high	Low condenser air flow (indicated by excessively warm air leaving the condenser fan) Air or other non-condensable gas in system Over charge of refrigerant	Open air passages. Clean coil. Check condenser fan Reclaim system and recharge. Install new filter/drier Reclaim excess refrigerant from unit
Head pressure too low	Loss of refrigerant (indicated by bubbles in sight glass)	Repair leak and recharge system
Suction pressure too low	Expansion valve stuck in the open position (indicated by abnormally cold suction line). Low charge, flash gas in liquid line (indicated by bubbles in sight glass) Clogged filter/drier Obstructed expansion valve (indicated by loss of capacity) Loss of control fluid from expansion valve control head (indicated by bubbles in the sight glass)	Repair or replace valve. Repair leak and recharge system Replace filter/drier Replace valve Replace valve or control head
Heater fails to operate	High Temperature Overload trip Defective over-temp switch Defective contactor	Low or no air flow over heater elements Replace over-Temp. switch Replace contactor

7.2 Diagnostic Checks

7.2.1 Voltage Check

If there is a problem with a unit starting, or the compressor is cycling on its internal overload, the trouble may be due to improper electric service being supplied to the unit. The ECU is equipped with a phase monitor to detect improper voltage or phasing. If the phase monitor detects improper power, the ECU will not start. It will be necessary to check the voltage in the unit power connections. Check the status of the phase monitor to insure the 3 phase power is connected correctly to the unit. See Figure 7.1 to properly check voltage.

1. With the disconnect switch on, turn the thermostat so it does not call for cooling.

2. Read the voltage at the Disconnect from L1-L2, L1-L3 and L2-L3. This is called "idle" voltage.

3. Turn the thermostat to call for cooling. With unit running, read the voltage at the Disconnect from L1-L2, L1-L3 and L2-L3. This is called "running voltage".

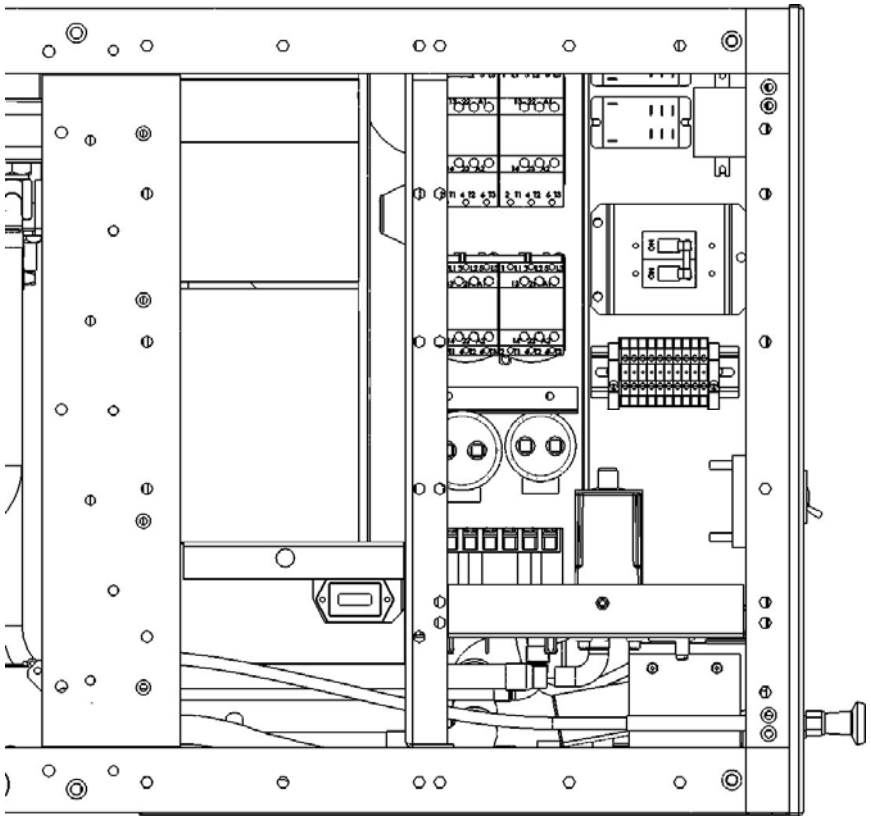


Figure 7.1

If the voltage is correct, and the phase monitor has a red light, then the incoming power is phased improperly. Switching L1 and L2 wires at the power source (with the power off) will usually correct improper power phasing. Do not change the internal wiring of the ECU. Running an ECU with improper phasing can cause severe compressor and prop fan damage.

If the voltage drops more than 20% between idle and running voltage then the motors in the unit will overheat. Some common causes of voltage drop include service transformers that are overloaded, service wiring that is too small, or too small a generator.

7.2.2 Electrical Component Diagnostics

To determine the possible failure of electrical components, the diagnostic tests in Table 7-2 can be used by a qualified technician. A legend of component abbreviations is provided in Table 7-3.

WARNING!
Many diagnostic tests require power to be present. Extreme care must be exercised to avoid injury or DEATH. High voltage is present in the electrical panel.

Electrical Component Diagnostics

Table 7.2

Transformer (T1)	***Power must be connected.*** Test H1 and H2 should read 208VAC. Test X1 and X2 should read 24VAC. Check control circuit breaker (CB2) for a trip condition.
Circuit Breaker 1 and 2 (CB1&CB2)	In the off position. Down or bottom (CB1) & Left (CB2) should have no continuity from line side to load side. In the ON position you should have continuity on all phases.
P1/J2	Ohm out cable. Factory color code is Black/White/Red/Green
All Motors Compressor Motor (1M)	Test each wire to ground for short, this applies to all motors Remove plug from compressor assembly. Test each pin to ground for short. Test wires 10 to 11 and 11 to 12 and 12 to 10 continuity should be present. (R to S, S to T & T to R)
Evap Fan Motor (3M)	Test wires 33 to 34, 35 to ground for short, continuity should not be present. Test capacitors
Condenser Fan Motor (4M)	Test wires 40 to 41, 41 to 42 and 42 to 40 High speed winding. Test wires 43 to 44, 44 to 45 and 45 to 43 Low speed winding Continuity should be present between legs.
3 phase Contactors (1MC,4MH,4ML,HC1)	1.) Test 1to2 3to4 5to6 continuity should not be present. 2.) A1 to A2 continuity should be present. *** To apply power ensure that tests 1 and 2 are correct.*** 3.) Connect power and check for amp draw. Amp draw should be .3 amps, 4.) Ensure you have continuity from 1to2 3to4 5to6. Aux contactor 21to22 should not have continuity.
Evaporator &Control relays (3MC, R2 & R4)	***No Power is Applied for test. 3MC & R2*** 1.) 1 and 0 should have continuity (coil of relay). 2.) Continuity from 6 to 7 and 2 to 3. 3.) No continuity from 6 to 8 and 2 to 4. ***R4 Relay*** 1.) A to B should have continuity (coil of relay). 2.) Continuity from 1 to 7 and 3 to 9. 3.) No continuity from 1 to 4 and 3 to 6.
Phase Monitor (PM1)	***No Power is applied for first test.*** Ohm out wires and check for proper connections, Black L1, Red L2, Blue L3, Green GND. Check for proper voltage from L1, L2 and L3. ***Power is applied*** 1.) Check 24 VAC control power is present from transformer. X1 & X2. 2.) Green LED should come on when power is applied. 3.) Check pins 1 to 2 for 0 VAC. 2 to 3 for 24 VAC. Should be present 4.) Disconnect wire L1 from monitor. Red LED should come on. 2 to 3 should be 0 VAC.

Bypass Solenoid (1V)	Normally closed solenoid. When you remove power from the Solenoid you should hear a click. Pin 1 to 2 should have continuity. When you apply power there should not be any voltage difference from one side to the other. Check coil for continuity across wire 117 and L3.
Overload protectors (4MOT)	***No Power is Applied for test*****.** Test wires J1 to J2 with motor off you should have continuity. If J1 and J2 are open and motor is cool to touch replace motor.
Mode Selector Switch (SS1), (Remote Mounted), (Off / Fan / Auto)	***No Power is Applied for test*****. Off:** Test wires 250 to 252 & 251 no continuity should be present. **Fan:** Test wires 250 to 252 they should have continuity and wires 250 and 252 to 251 should have no continuity. **Auto:** Test wires 250 to 252 and 250 to 251 they should have continuity.
Evaporator Speed Selector Switch (SS2), (High / Low) (Remote Mounted),	***No Power is Applied for test.*** **Low Speed:** Wires 252 to 258 should have continuity. **High Speed:** Wires 252 to 258 should have no continuity.
Freeze Thermostat (FST)	***No Power is Applied for test.*** test for no continuity between wire 1 and 3, there should be continuity between wire 1 and 2.
Condenser Fan Cycle Switch (PS1)	Disconnect all three wires. Test terminals WHT and BLK, continuity should exist. WHT to RED should have no continuity. See Figure 7.2.
HPC/LPC (PS2,PS3)	***No Power is Applied for test.*** Test terminals 1 and 2, continuity should exist when charged. See Figure 7.2.
Anti Short Cycle Timer (TST)	***Must connect power.*** Turn unit on and turn SS1 to the AUTO Mode, then turn SS1 to OFF. Turn unit back on to AUTO. It should take 2 minutes for the compressor to restart. (The temperature setting on the thermostat must be set lower than the room temperature.)
Low ambient bypass timer (TST)	***Must Connect Power***. COM to TIMER OUT should have continuity for 2 minutes and then it should open.
Heater Cutout Switch (HT1)	Should have continuity from 1 to 2. at temperatures lower than 130 deg. F.

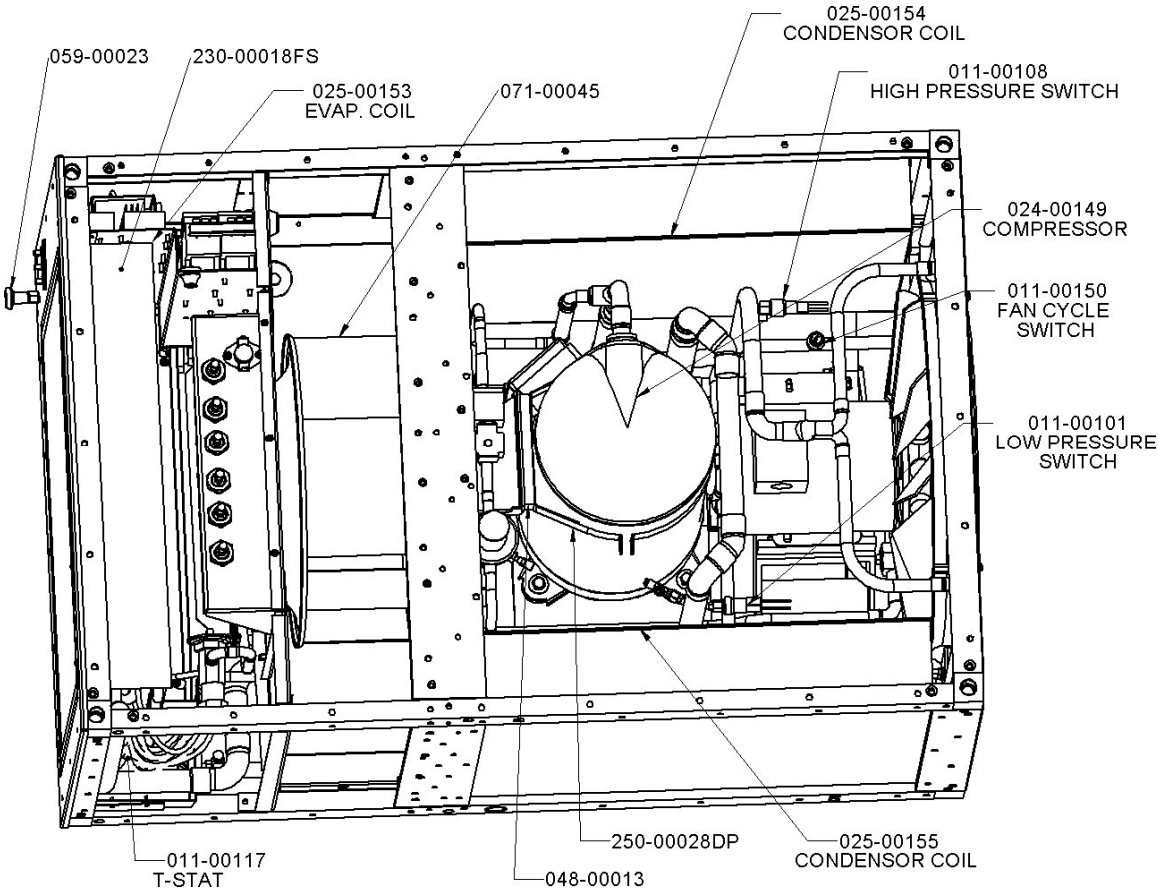


Figure 7.2

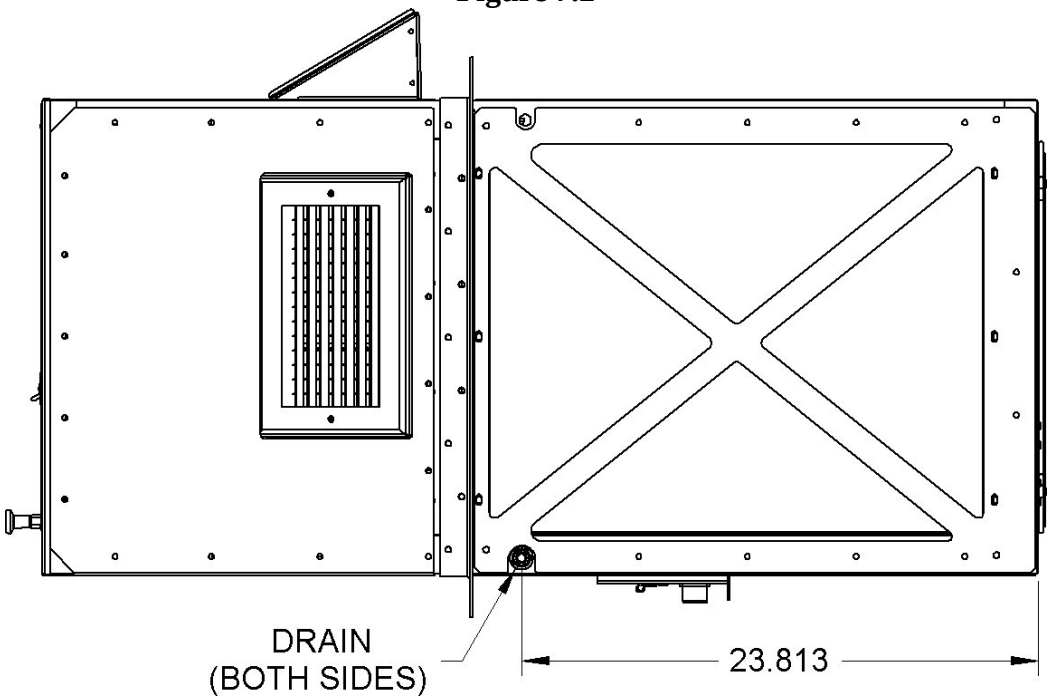


Figure 7.3

Table 7.4

Electrical Component Legend

T1	Transformer
J1	Power Receptacle
CB1	Circuit Breaker Main 40 Amp
CB2	Circuit Breaker Primary Control 1 Amp
1M	Compressor Motor
3M	Evap Blower Motor
4M	Condenser Motor
1MC	Compressor Contactor
3MC	Evap Fan Low speed Contactor
4ML	Condenser Fan Low speed Contactor
4MH	Condenser Fan High speed Contactor
HC1	Heater Contactor
HT1	Heater Cutout
HE1	Heater Element Bank 6KW
R4	Evap Fan High speed Contactor
PM	Phase Monitor
R2	Bypass Relay from Temp. controller
1V	Bypass Shut-Off Solenoid
4MOT	Overload Condenser Fan
R2	Remote Control Plug
HM	Hour Meter
PS1	Condenser Fan Cycle Switch
PS2	HPC (High Pressure Switch)
PS3	LPC (Low Pressure Switch)
FST	Freeze Stat.
CAP1	Evap. Run Capacitor
CAP2	Evap. Low Speed Capacitor
	REMOTE PARTS
LT1	Power On Light
LT2	Phase Failure / Voltage Light
J1	Remote Receptacle
SS1	Mode Selector switch (Remote Mounted)
SS2	Evaporator Hi / Low Speed Switch (Remote Mounted)
TST	Digital Thermostat

7.2.3 Scroll Compressor Check

Scroll compressors do not have internal suction valves or dynamic discharge valves which can be damaged, so it is not necessary to perform functional compressor tests where the compressor is turned on with the suction service valve closed to check how low the compressor will pull suction pressure. In fact, this type of test may actually damage a scroll compressor (and other types of compressors, also). The following diagnostic procedure should be used to evaluate whether a Scroll compressor is functioning properly.

1. Verify proper voltage to the ECU.

2. Verify proper indoor and outdoor fan/blower rotation direction.

3. If the compressor will not run, the normal checks of motor winding continuity and short to ground should be made to determine if the inherent internal overload motor protector has opened or if an internal short to ground has developed.

4. If the protector has opened, the compressor must be allowed to cool sufficiently to allow it to reset.

5. With service gauges connected to suction and discharge pressure fittings, energize the compressor.

6. If suction pressure falls below normal levels the system is either too low on charge or there is a flow blockage in the system (refrigerant or air).

7. If suction pressure does not drop and discharge pressure does not rise to normal levels, the compressor is faulty.

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CHAPTER 7

SUPPLEMENTAL TROUBLESHOOTING PARAGRAPHS

EVIRONMENTAL CONTROL UNIT (ECU) DOES NOT START 7.1

THIS WORK PACKAGE COVERS:
Electrical System Troubleshooting

INITIAL SETUP:

Maintenance Level
Field

Tools/Special Tools
Tool Kit, Genl Mech (NSN 5180-01-454-3787)
Multimeter (NSN 6625-01-368-0842)
Lead, Test (NSN 6625-01-335-3088)

Materials/Parts
Ties, Cable, Plastic (NSN 5975-01-379-4997)
Wire, Electrical 50 ft (NSN 6145-01-148-2263)

References
TM 9-2320-391-20 FMTV IETM (Electrical Wire and Cable Repair)

Personnel Required
Two

Equipment Conditions
Left side access panel removed (Chapter 6.24)
Disconnect power to AC (TM 9-2320-392-10)

PROCEDURE

WARNING

Remove rings, bracelets, watches, necklaces, and any other jewelry before working around vehicle. Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Failure to comply may result in injury to personnel.

Use care when working around ECU. High voltage is present. Failure to comply may result in injury to personnel.

CAUTION

Use care when testing electrical connectors. Do not damage connector pins or sockets with multimeter probes. Failure to comply may result in damage to equipment.

NOTE

Refer to Electrical Schematic as required.

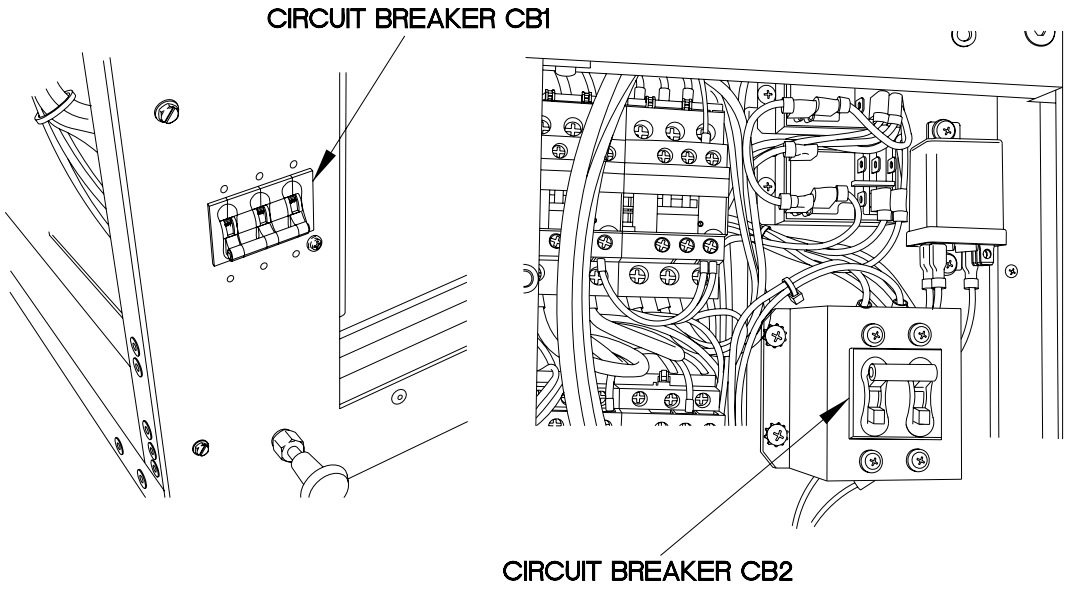
Remove plastic cable ties as required.

Tag hoses and connection points prior to disconnecting.

ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

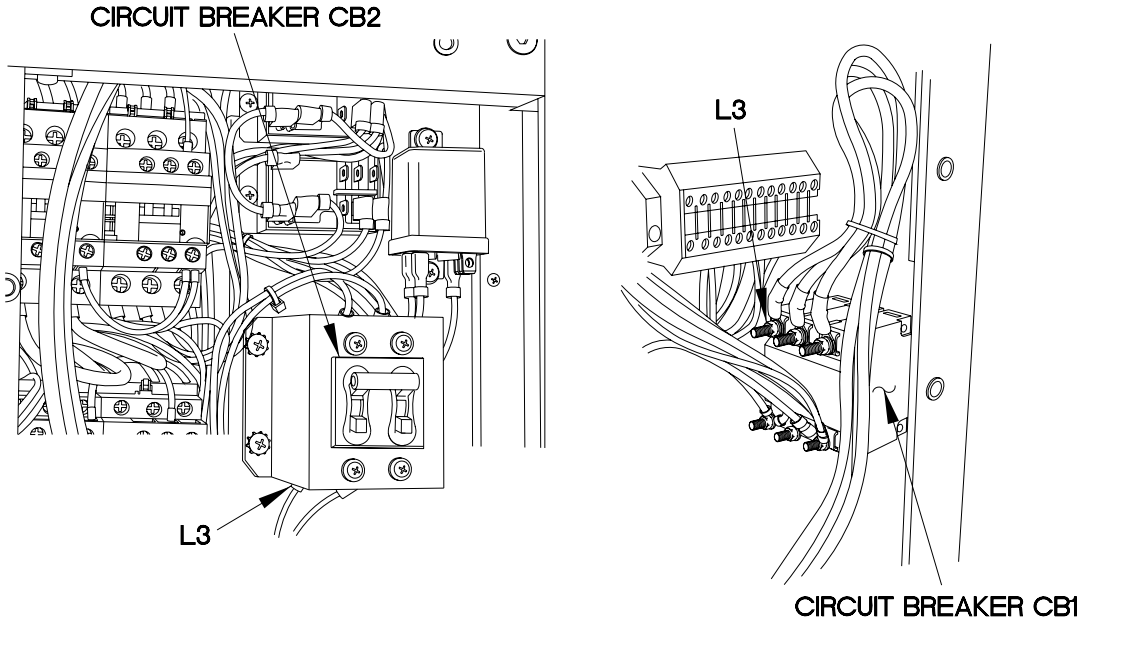
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
1. Is continuity present between CB1 and CB2 with circuit breakers in ON position?	No Repair wire L3 (TM 9-2320-391-20) or replace circuit breakers (Chapter 6.20).	1. Set multimeter to ohms.
	Yes Go to (Indication/Condition 2).	2. Position circuit breaker CB1 to ON. 3. Position circuit breaker CB2 to ON.



ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

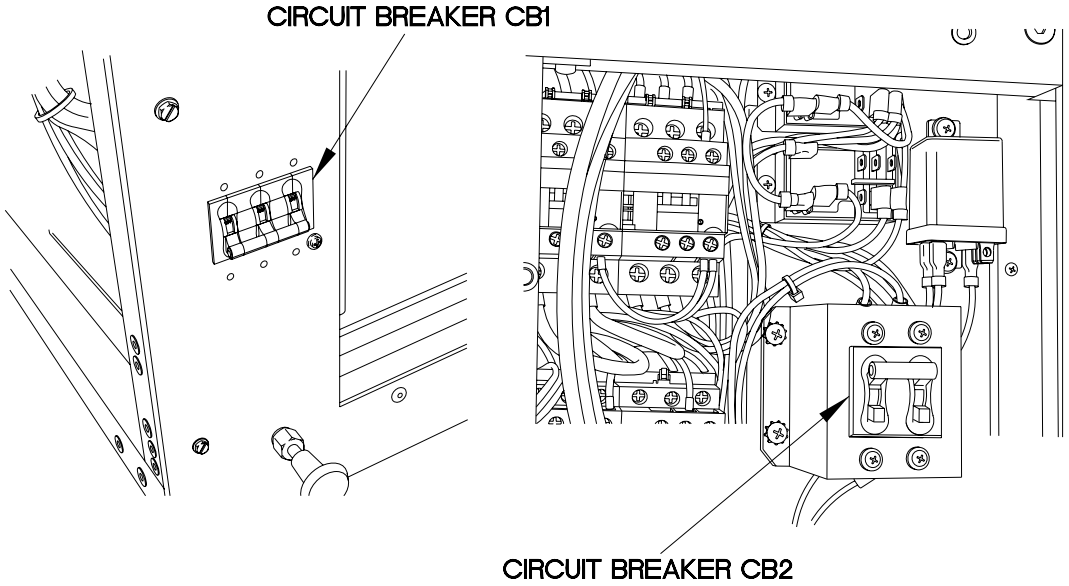
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
1. Is continuity present between CB1 and CB2 with circuit breakers in ON position?-Continued	No Repair wire L3 (TM 9-2320-391-20) or replace circuit breakers (Chapter 6.20). Yes Go to (Indication/Condition 2).	4. Connect positive (+) probe of digital multimeter to circuit breaker CB1-L3. 5. Connect negative (-) probe of digital multimeter to circuit breaker CB2-L3. 6. Note reading on digital multimeter.



ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

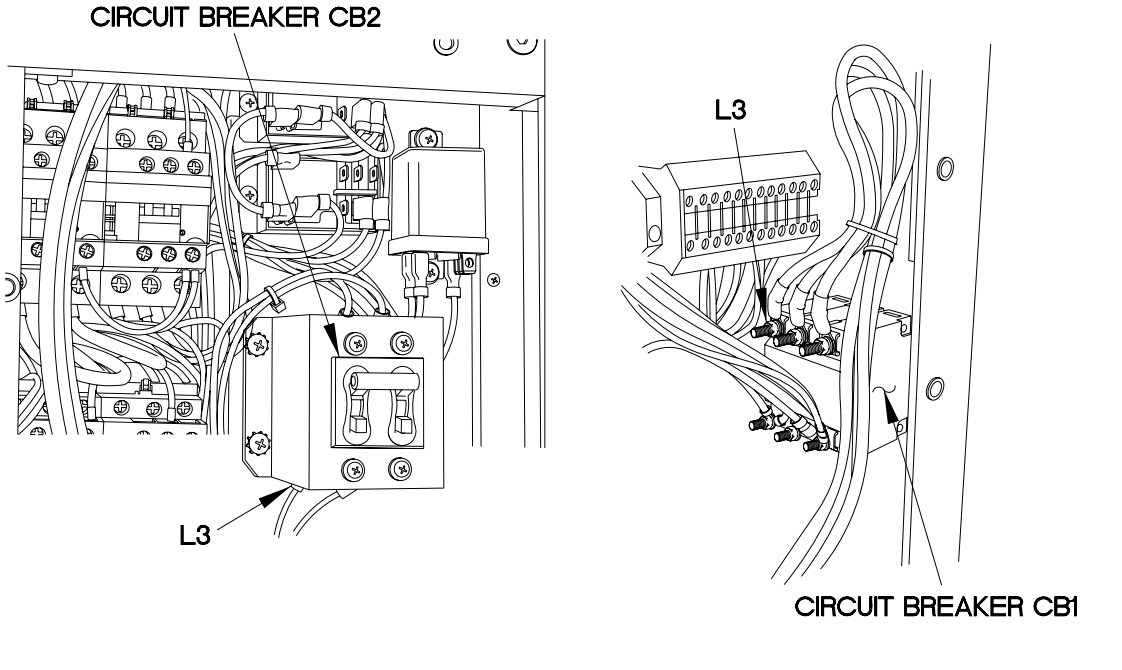
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
2. Is continuity present between CB1 and CB2 with circuit breakers in OFF position?	No Go to (Indication/Condition 3).	1. Position circuit breaker CB1 to OFF.
	Yes Repair wire L3 (TM 9-2320-391-20) or replace circuit breakers (Chapter 6.20).	2. Position circuit breaker CB2 to OFF.



ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

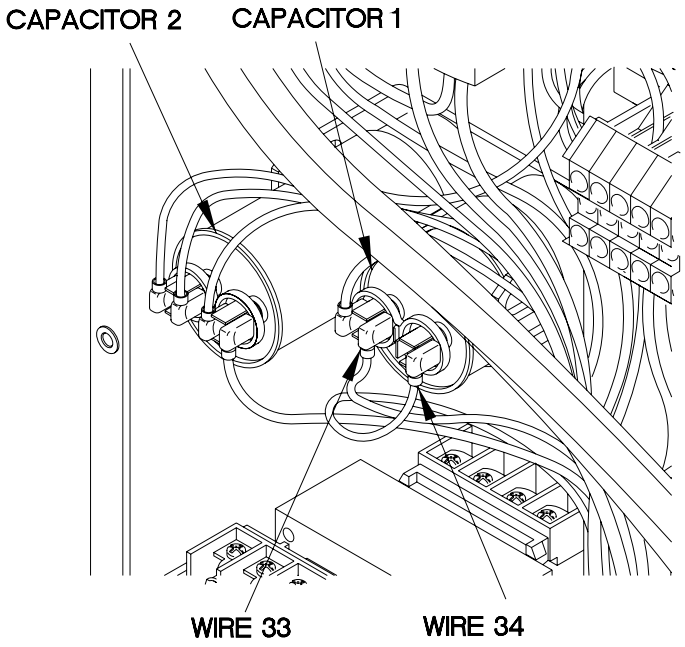
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
2. Is continuity present between CB1 and CB2 with circuit breakers in OFF position?-Continued	No Go to (Indication/Condition 3).	3. Connect positive (+) probe of digital multimeter to circuit breaker CB1-L3.
	Yes Repair wire L3 (TM 9-2320-391-20) or replace circuit breakers (Chapter 6.20).	4. Connect negative (-) probe of digital multimeter to circuit breaker CB2-L3. 5. Note reading on digital multimeter.



ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
3. Is continuity present from Evaporator fan motor (3M) to ground?	No Go to (Indication/Condition 4). Yes Repair wire (TM 9-2320-391-20).	1. Connect positive (+) probe of digital multimeter to capacitor 1-1 wire 33. 2. Connect negative (-) probe of digital multimeter to known good ground.
		3. Note reading on digital multimeter. 4. Connect positive (+) probe of digital multimeter to capacitor 1-2 wire 34. 5. Connect negative (-) probe of digital multimeter to a known good ground. 6. Note reading on digital multimeter.



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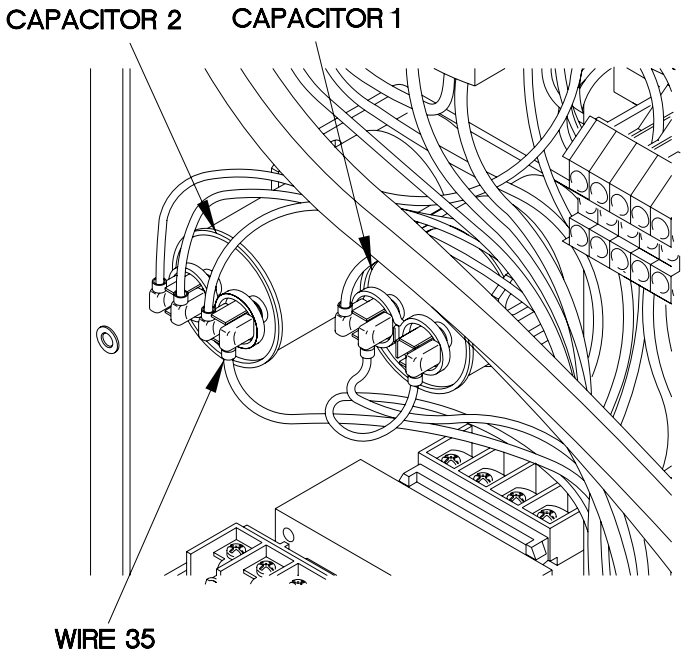
ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
3. Is short present from Evaporator fan motor (3M) to ground?-Continued	No Go to (Indication/Condition 4). Yes Repair wire (TM 9-2320-391-20).	7. Connect positive (+) probe of digital multimeter to capacitor 2-2 wire 35. 8. Connect negative (-) probe of digital multimeter to a known good ground. 9. Note reading on digital multimeter.



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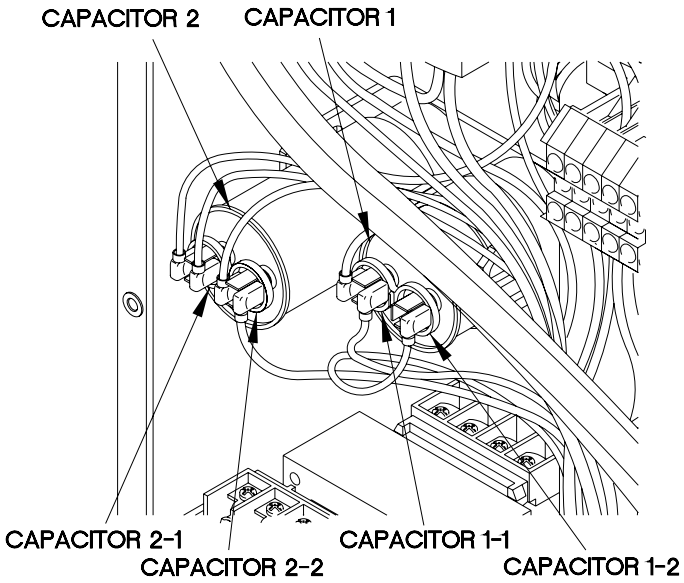
ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
4. Is continuity across capacitors present?	No Replace capacitor (Chapter 6.17). Yes Go to (Indication/Condition 5).	1. Connect positive (+) probe of digital multimeter to capacitor 1-1. 2. Connect negative (-) probe of digital multimeter to capacitor 1-2. 3. Note reading on digital multimeter. 4. Connect positive (+) probe of digital multimeter to capacitor 2-1. 5. Connect negative (-) probe of digital multimeter to capacitor 2-2. 6. Note reading on digital multimeter. 7. If continuity is not present, replace capacitor (Chapter 6.17).



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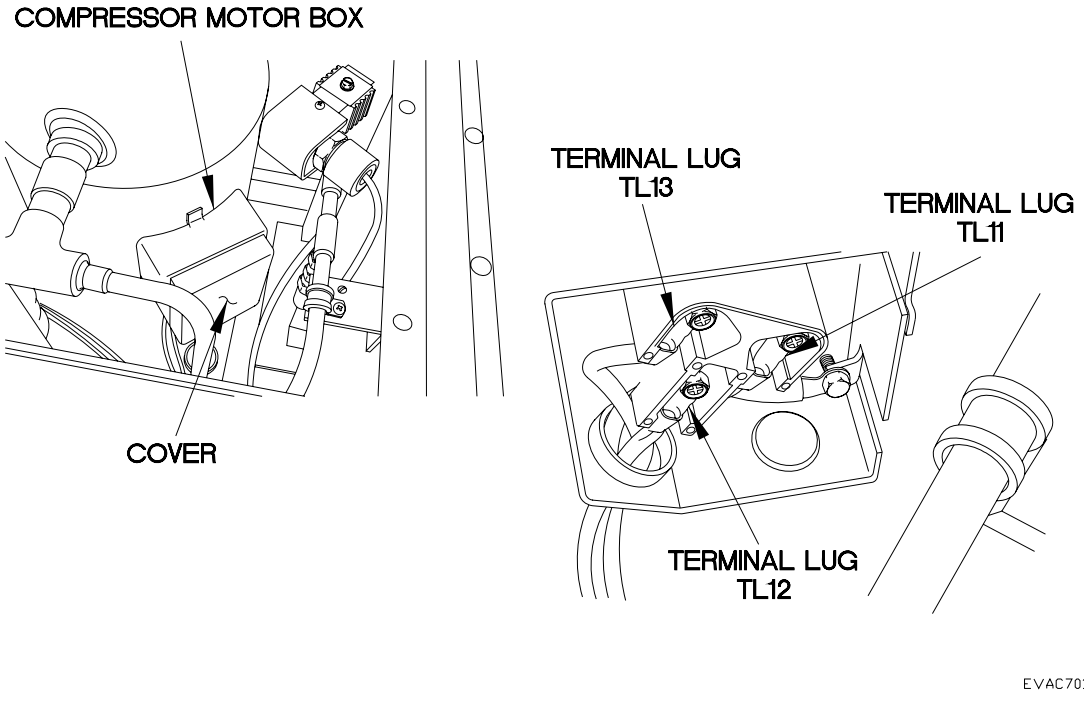
ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

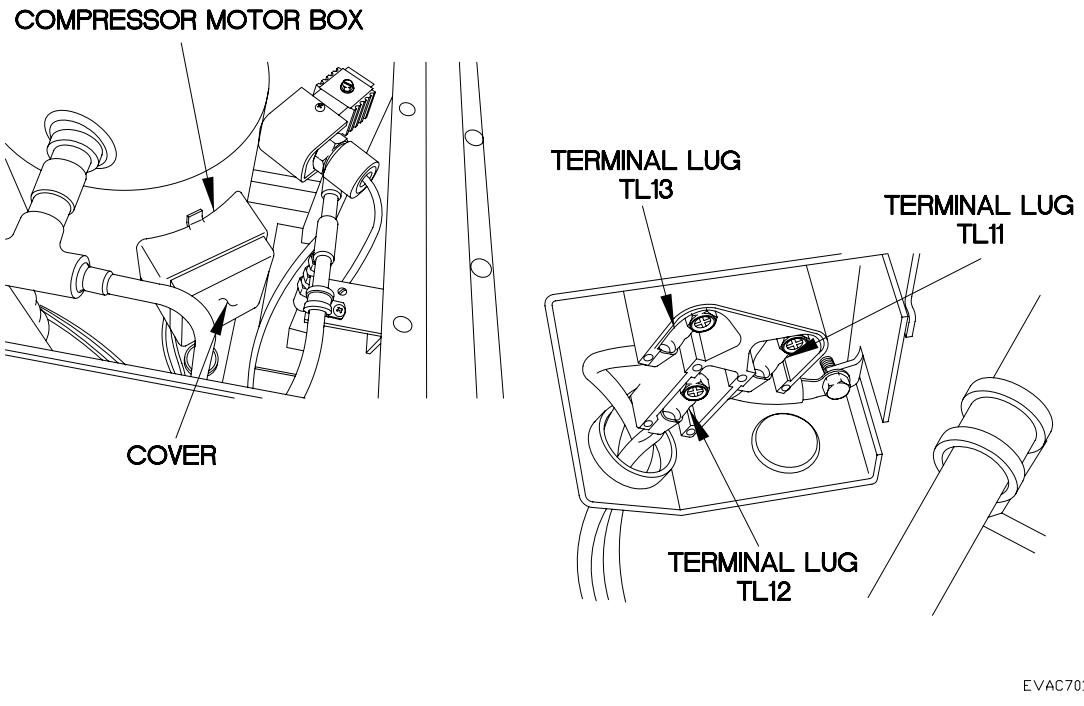
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
5. Is continuity present from terminal lugs to ground?	No Go to (Indication/Condition 6). Yes Repair wire 11, 12, or 13 (TM 9-2320-391-20).	1. Remove AC panel for access (Chapter 6.24). 2. Remove cover from compressor motor box. 3. Connect positive (+) probe of digital multimeter to a known good ground. 4. Connect negative (-) probe of digital multimeter to compressor control box TL-11.



ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

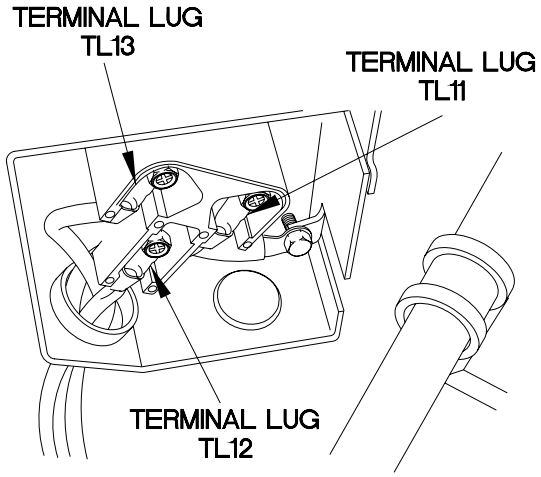
Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
5. Is continuity present from terminal lugs to ground?-Continued	No Go to (Indication/Condition 6).	5. Note reading on digital multimeter.
	Yes Repair wire 11, 12, or 13 (TM 9-2320-391-20).	6. Connect negative (-) probe of digital multimeter to compressor control box TL-13. 7. Note reading on digital multimeter. 8. Connect negative (-) probe of digital multimeter to compressor control box TL-12. 9. Note reading on digital multimeter.



ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

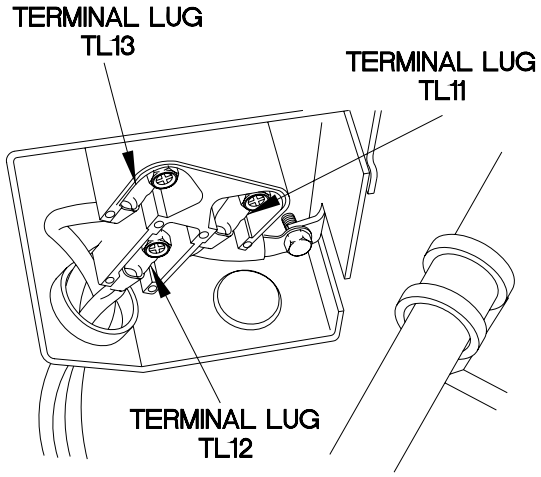
Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
6. Is continuity present from TL-12 to TL-13 to TL-11?	No Replace compressor (Chapter 6.9). Yes Go to (Indication/Condition 7).	1. Connect positive (+) probe of digital multimeter to compressor box TL-12. 2. Connect negative (-) probe of digital multimeter to compressor box TL-13.  EVAC701A04 3. Note reading on digital multimeter. 4. Connect negative (-) probe of digital multimeter to compressor box TL-11. 5. Note reading on digital multimeter.

ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
6. Is continuity present from TL-12 to TL-13 to TL-11?-Continued	No Replace compressor (Chapter 6.9).	6. Connect positive (+) probe of digital multimeter to compressor box TL-13.
	Yes Go to (Indication/Condition 7).	7. Note reading on digital multimeter.



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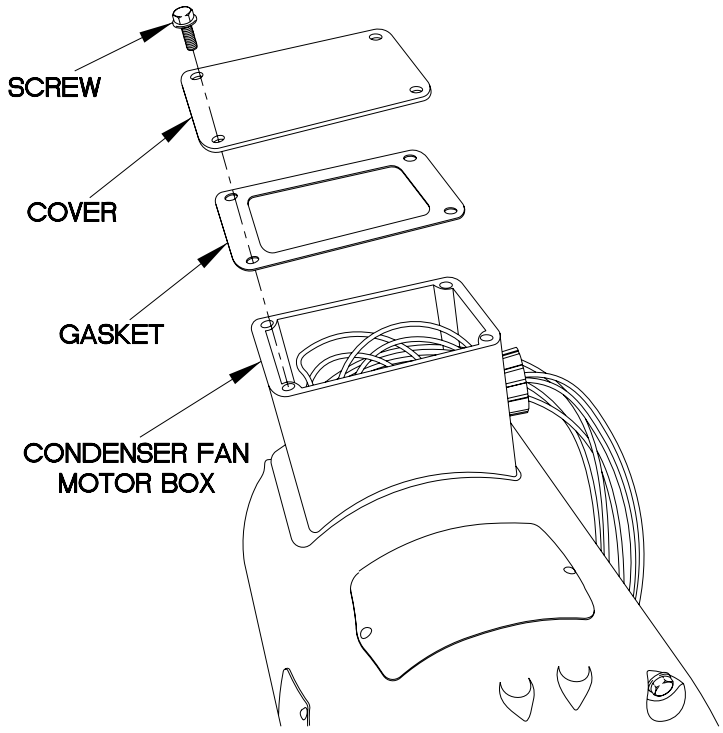
ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

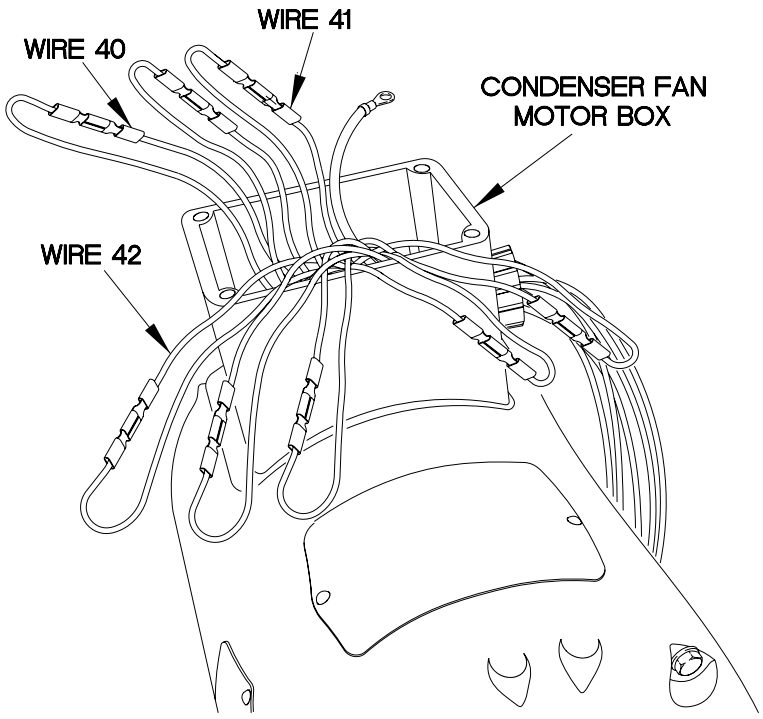
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
7. Is continuity present between correct wire connections?	No Repair wires (TM 9-2320-391-20). Yes Go to (Indication/Condition 8).	1. Remove four screws, gasket and cover from condenser fan motor box. 2. Connect positive (+) probe of digital multimeter to condenser fan motor box wire 40.



ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

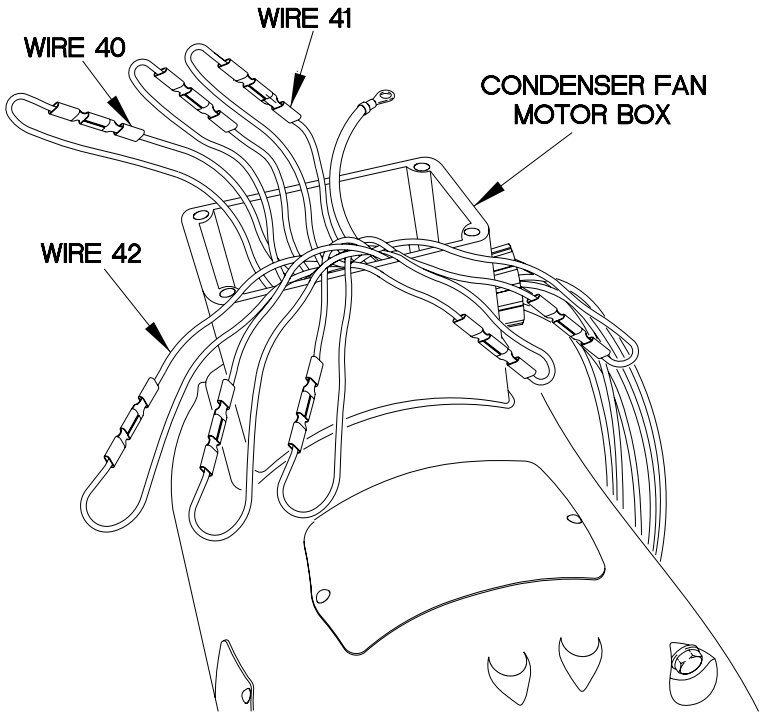
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
7. Is continuity present between correct wire connections on high speed winding?-Continued	No Repair wires (TM 9-2320-391-20).	3. Connect negative (-) probe of digital multimeter to condenser fan motor box wire 41.
	Yes Go to (Indication/Condition 8).	4. Note reading on digital multimeter.
		5. Connect positive (+) probe of digital multimeter to condenser fan motor box wire 42.
		6. Note reading on digital multimeter.
		7. Connect negative (-) probe of digital multimeter to condenser fan motor box wire 40.



ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

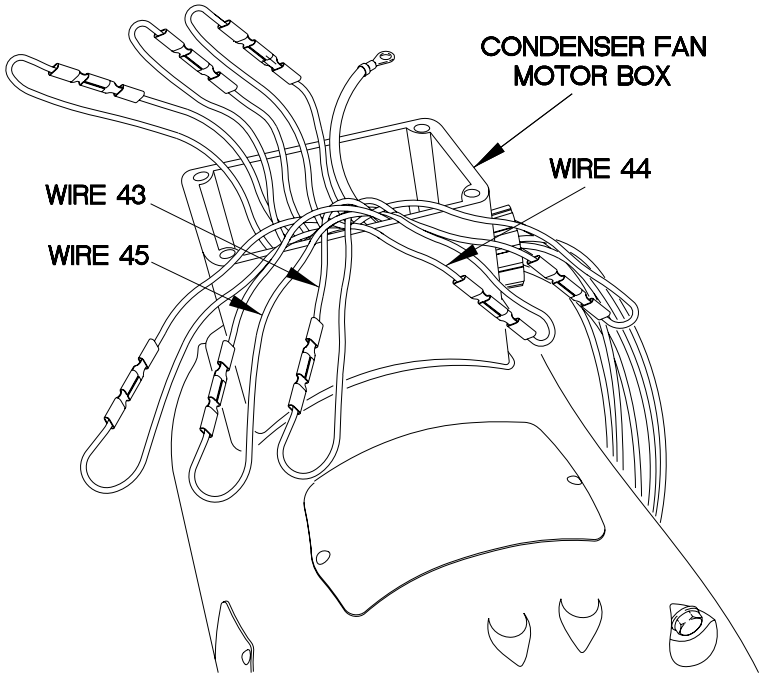
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
7. Is continuity present between correct wire connections on high speed winding?-Continued	No Repair wires (TM 9-2320-391-20). Yes Go to (Indication/Condition 8).	8. Note reading on digital multimeter.



ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
8. Is continuity present between correct wire connections on low speed winding?	No Repair wires (TM 9-2320-391-20). Yes Go to (Indication/Condition 9).	1. Connect positive (+) probe of digital multimeter to condenser fan motor box wire 43. 2. Connect negative (-) probe of digital multimeter to condenser fan motor box wire 44. 3. Note reading on digital multimeter.



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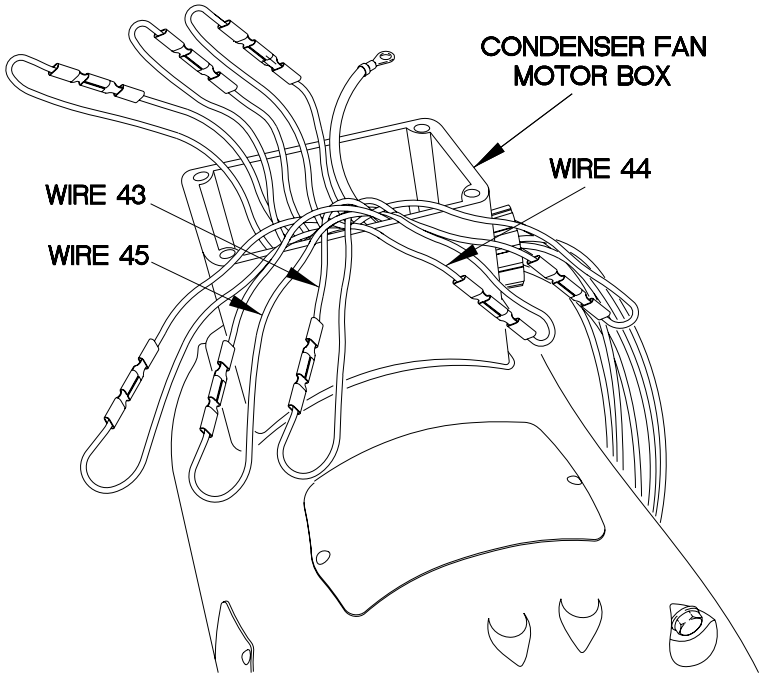
ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
8. Is continuity present between correct wire connections on low speed winding?-Continued	No Repair wires (TM 9-2320-391-20).	4. Connect positive (+) probe of digital multimeter to condenser fan motor box wire 45.
	Yes Go to (Indication/Condition 9).	5. Note reading on digital multimeter.
		6. Connect negative (-) probe of digital multimeter to condenser fan motor box wire 43.



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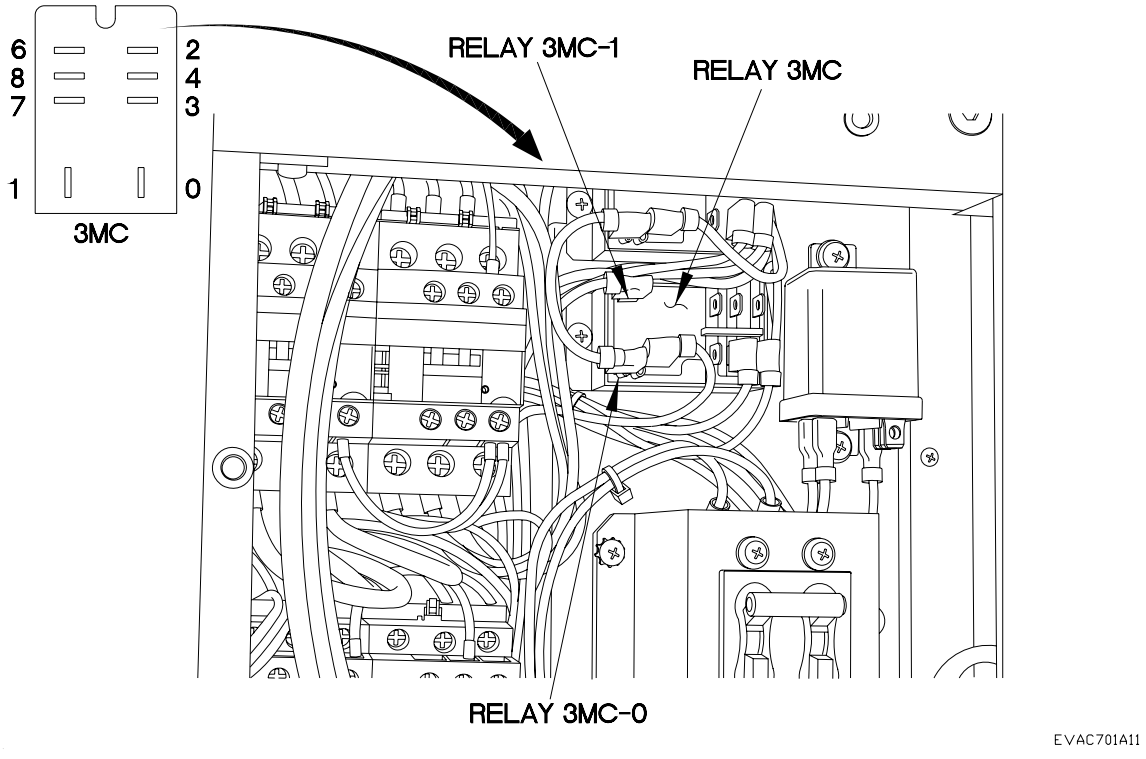
ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

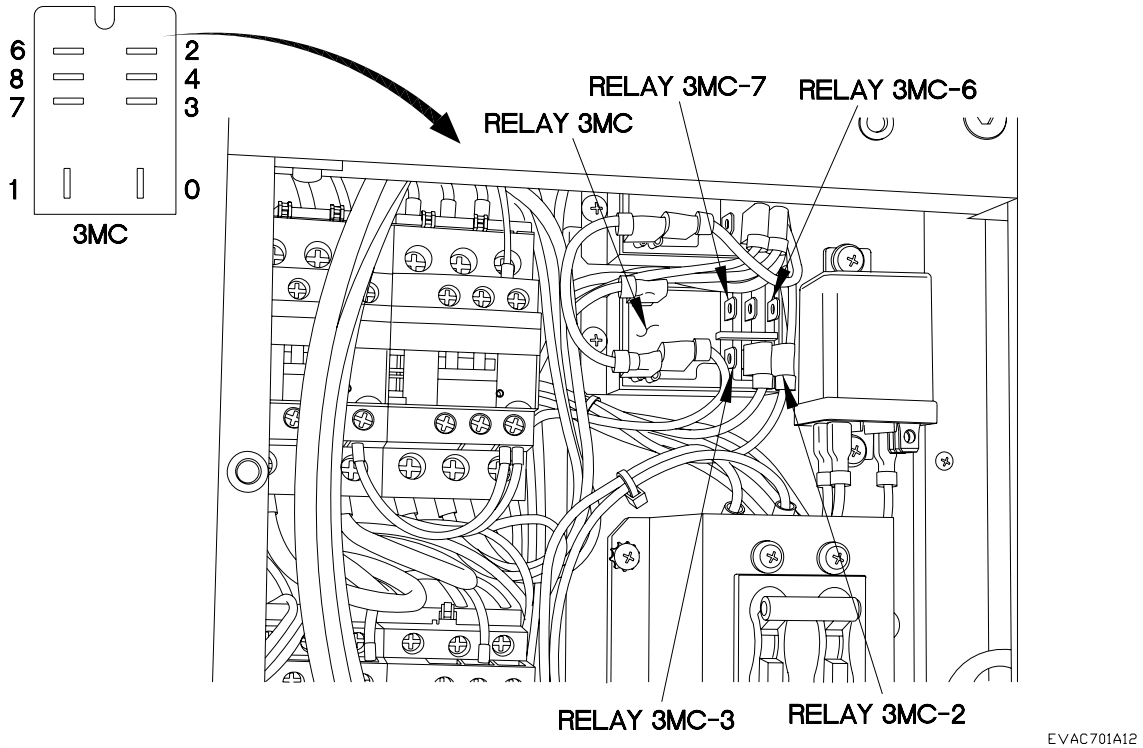
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
8. Is continuity present between correct wire connections on low speed winding?-Continued	No Repair wires (TM 9-2320-391-20).	7. Note reading on digital multimeter.
	Yes Go to (Indication/Condition 9).	
9. Is continuity present across Evap start relay (3MC)?	No Replace relay 3MC (Chapter 6.19).	1. Connect positive (+) probe of digital multimeter to relay 3MC-1.
	Yes Go to (Indication/Condition 10).	2. Connect negative (-) probe of digital multimeter to relay 3MC-0.
		3. Note reading on digital multimeter.



ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

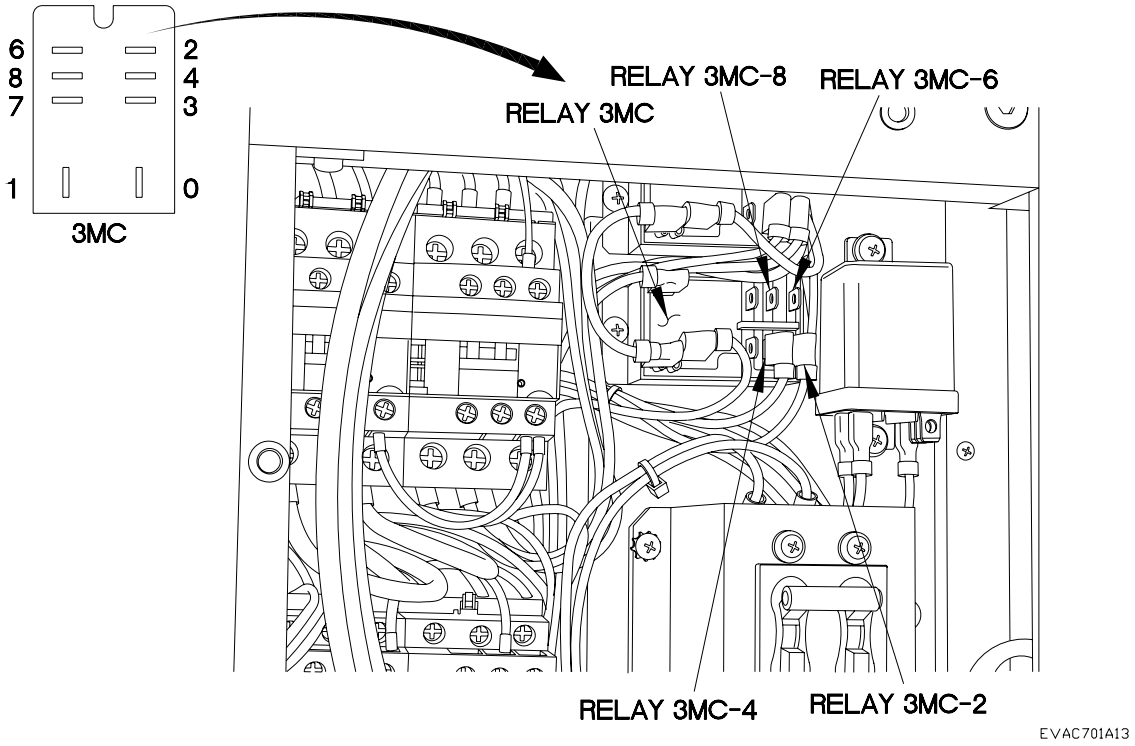
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
9. Is continuity present across Evap start relay (3MC)?-Continued	No Replace relay 3MC (Chapter 6.19). Yes Go to (Indication/Condition 10).	4. Connect positive (+) probe of digital multimeter to relay 3MC-6. 5. Connect negative (-) probe of digital multimeter to relay 3MC-7. 6. Note reading on digital multimeter. 7. Connect positive (+) probe of digital multimeter to relay 3MC-2. 8. Connect negative (-) probe of digital multimeter to relay 3MC-3. 9. If continuity is not present, replace relay 3MC (Chapter 6.19).



ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

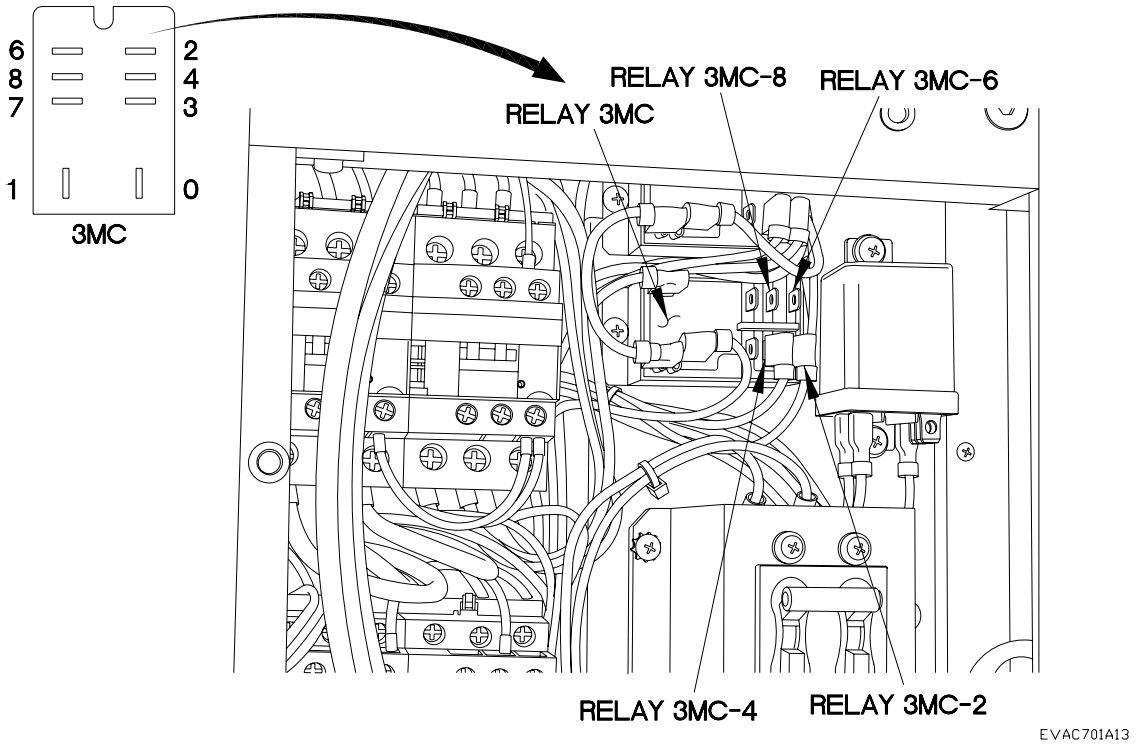
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
10. Is continuity not present across Evap start relay (3MC)?	No Go to (Indication/Condition 11). Yes Replace relay 3MC (Chapter 6.19). `	1. Connect positive (+) probe of digital multimeter to relay 3MC-6. 2. Connect negative (-) probe of digital multimeter to relay 3MC-8. 3. Note reading on digital multimeter.
		4. Connect positive (+) probe of digital multimeter to relay 3MC-2. 5. Connect negative (-) probe of digital multimeter to relay 3MC-4.



ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

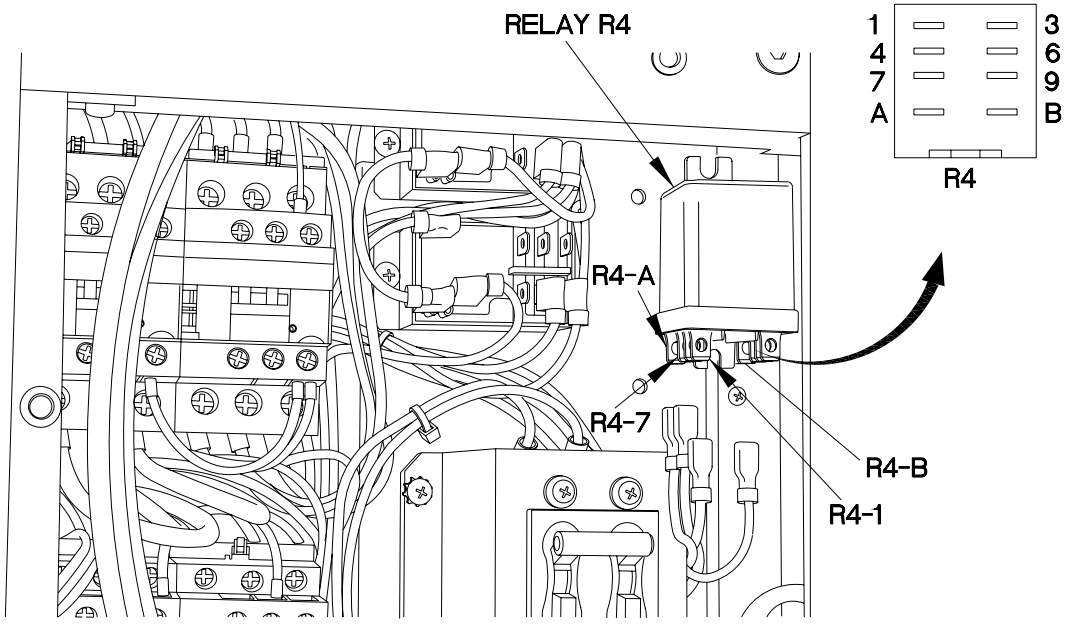
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
10. Is continuity not present across Evap start relay (3MC)?-Continued	No Go to (Indication/Condition 11). Yes Replace relay 3MC (Chapter 6.19).	6. Note reading on digital multimeter.



ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

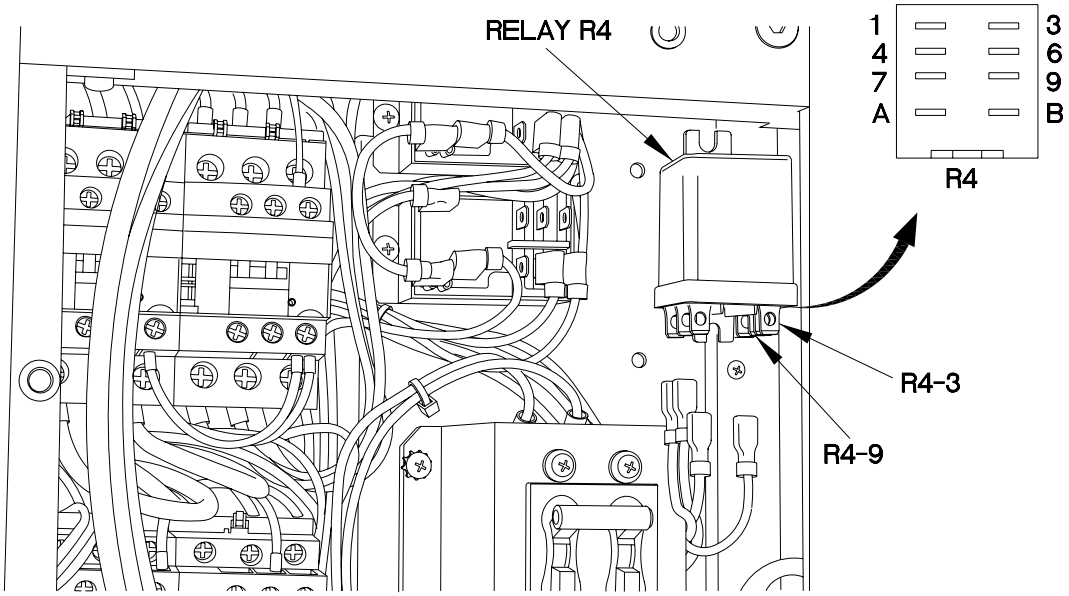
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
11. Is continuity present across Evap speed relay (R4)?	No Replace relay R4 (Chapter 6.19). Yes Go to (Indication/Condition 12).	1. Connect positive (+) probe of digital multimeter to relay R4-A. 2. Connect negative (-) probe of digital multimeter to relay R4-B. 3. Note reading on digital multimeter. 4. Connect positive (+) probe of digital multimeter to relay R4-1. 5. Connect negative (-) probe of digital multimeter to relay R4-7. 6. Note reading on digital multimeter.



ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

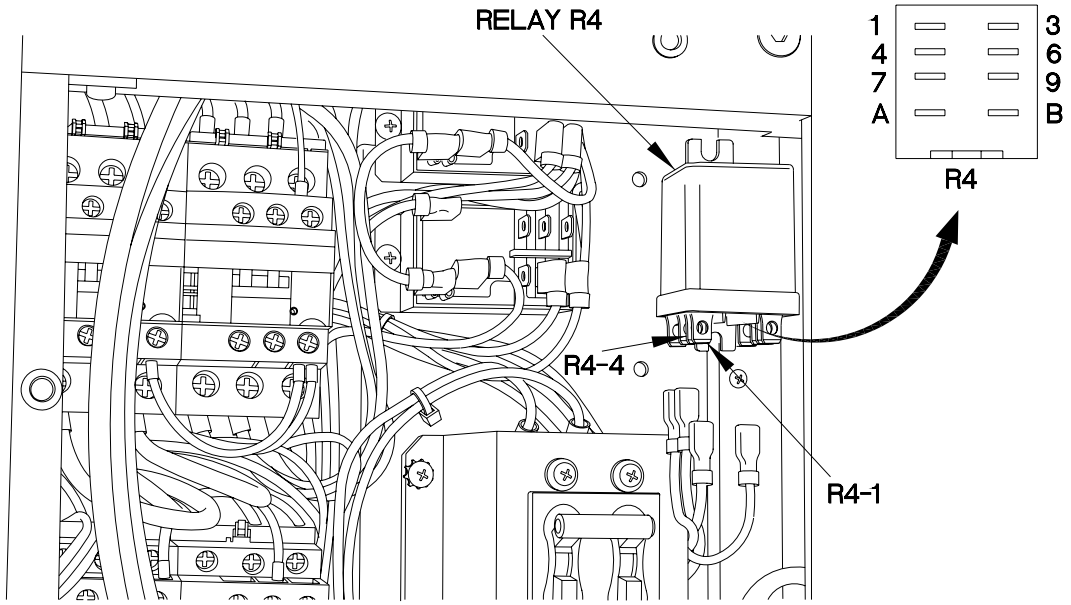
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
11. Is continuity present across Evap speed relay (R4)?-Continued	No Replace relay R4 (Chapter 6.19). Yes Go to (Indication/Condition 12).	7. Connect positive (+) probe of digital multimeter to relay R4-3. 8. Connect negative (-) probe of digital multimeter to relay R4-9. 9. Note reading on digital multimeter.



ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

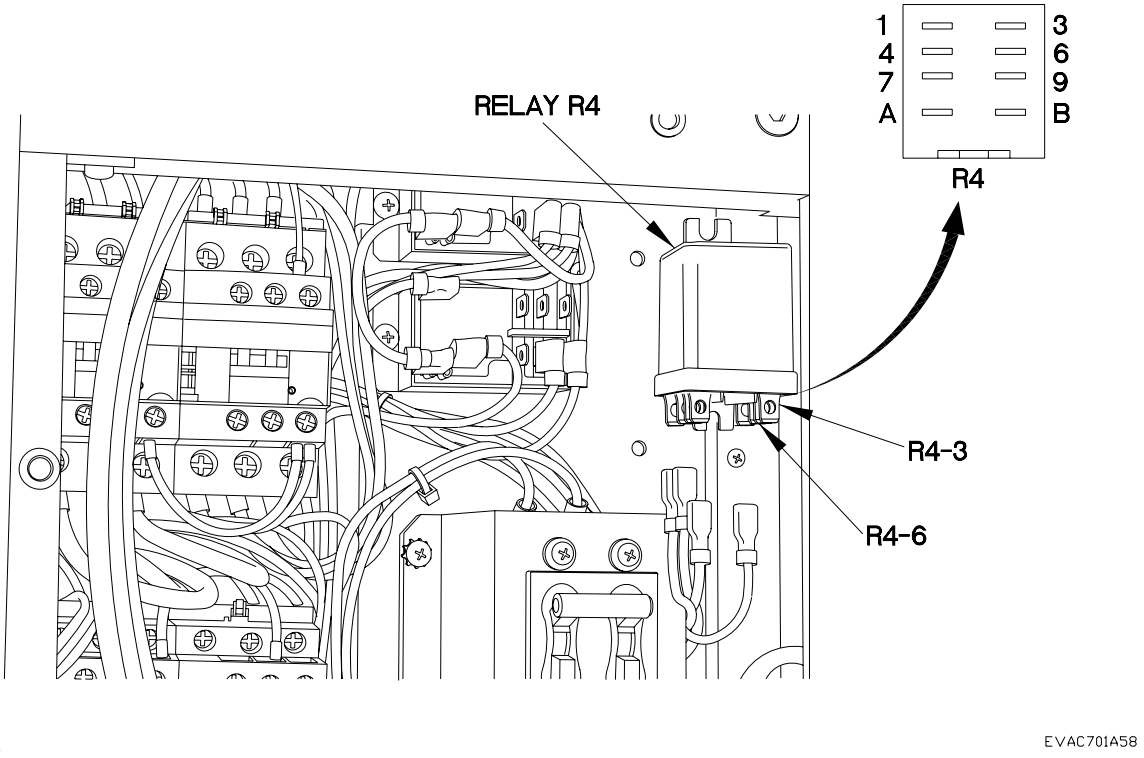
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
12. Is continuity present across Evaporator speed relay (R4)?	No Go to (Indication/Condition 13). Yes Replace relay R4 (Chapter 6.19).	1. Connect positive (+) probe of digital multimeter to relay R4-1. 2. Connect negative (-) probe of digital multimeter to relay R4-4. 3. Note reading on digital multimeter.



ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

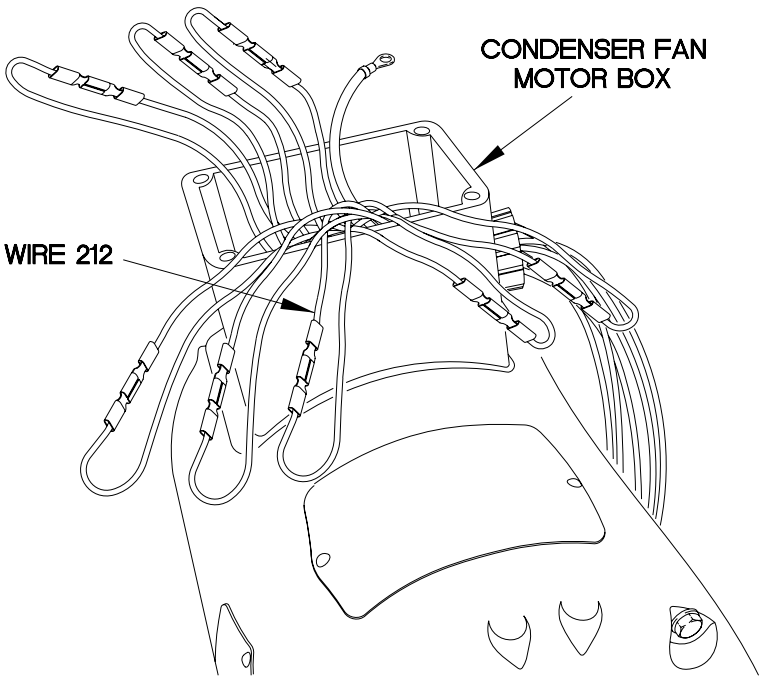
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
12. Is continuity present across Evaporator speed relay (R4)?-Continued	No Go to (Indication/Condition 13).	4. Connect positive (+) probe of digital multimeter to relay R4-3.
	Yes Replace relay R4 (Chapter 6.19).	5. Connect negative (-) probe of digital multimeter to relay R4-6.
		6. Note reading on digital multimeter.



ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
13. Is continuity present across wire 212?	No Repair wire (TM 9-2320-391-20) or replace motor (Chapter 6.14). Yes Go to (Indication/Condition 14).	1. Connect positive (+) probe of digital multimeter to wire 212 at motor box.

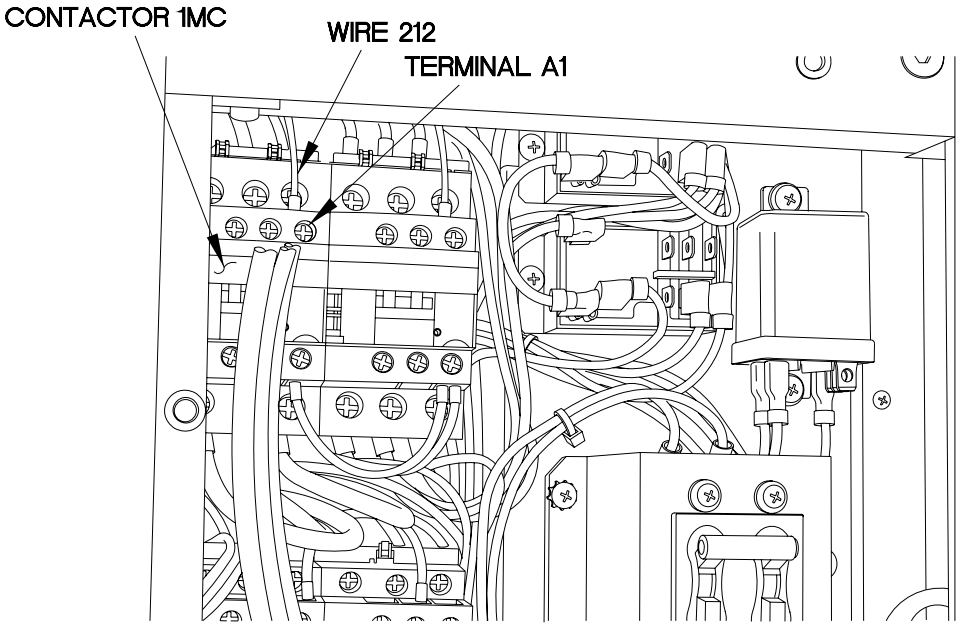


EVAC701A27

ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
13. Is continuity present across wire 212?-Continued	No Repair wire (TM 9-2320-391-20) or replace motor (Chapter 6.14).	2. Connect negative (-) probe of digital multimeter to wire 212 at contactor 1MC terminal A1.
	Yes Go to (Indication/Condition 14).	3. Note reading on digital multimeter.

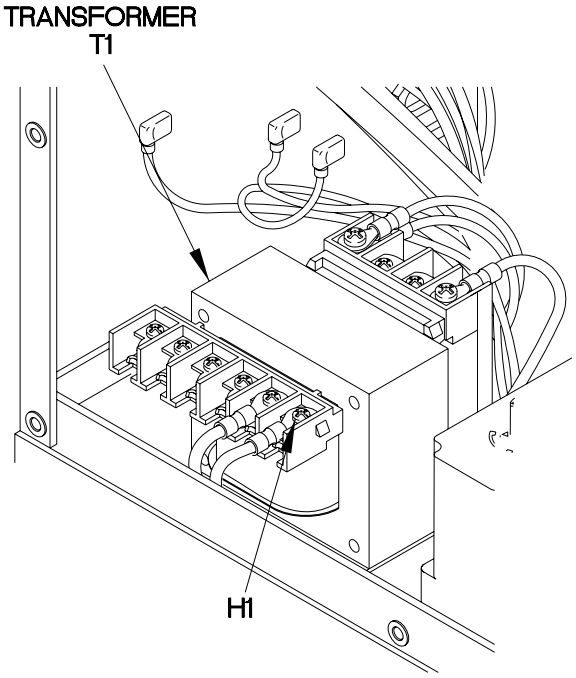


EVAC701A28

ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
14. Is 202-214 VAC present at T1-H1?	No If VAC reading is not correct, continue troubleshooting van referencing TM 9-2320-392-20.	1. Set multimeter to VAC.
	Yes Go to (Indication/Condition 15).	2. Turn on AC (Chapter 5).
		3. Connect positive (+) probe of digital multimeter to transformer H1.
		4. Connect negative (-) probe of digital multimeter to a known good ground.
		5. Reading should range between 202-241 VAC.

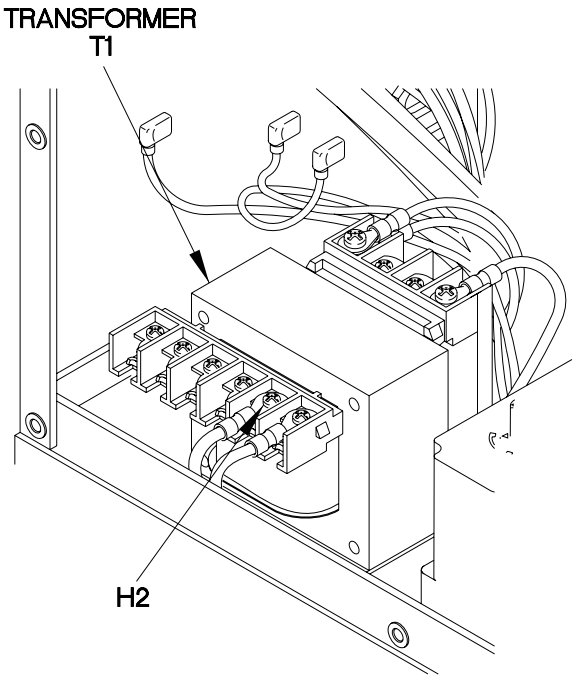


EVAC701A29

ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
15. Is 202-214 VAC present at T1-H2?	No Continue troubleshooting van referencing TM 9-2320-392-20. Yes Go to (Indication/Condition 16).	1. Connect positive (+) probe of digital multimeter to transformer H2. 2. Connect negative (-) probe of digital multimeter to a known good ground. 3. Reading should range between 202-241 VAC.

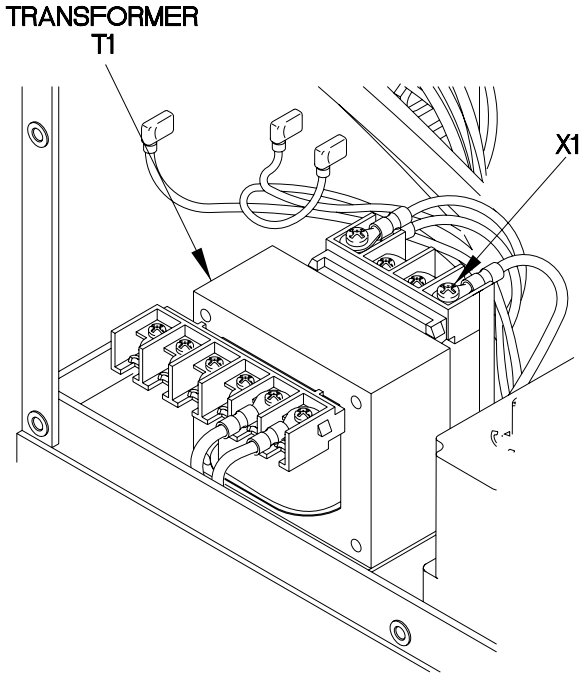


EVAC701A30

ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
16. Is 202-214 VAC present at T1-X1?	No Continue troubleshooting van referencing TM 9-2320-392-20. Yes Go to (Indication/Condition 17).	1. Connect positive (+) probe of digital multimeter to transformer X1. 2. Connect negative (-) probe of digital multimeter to a known good ground. 3. Reading should range between 18-30 VAC.

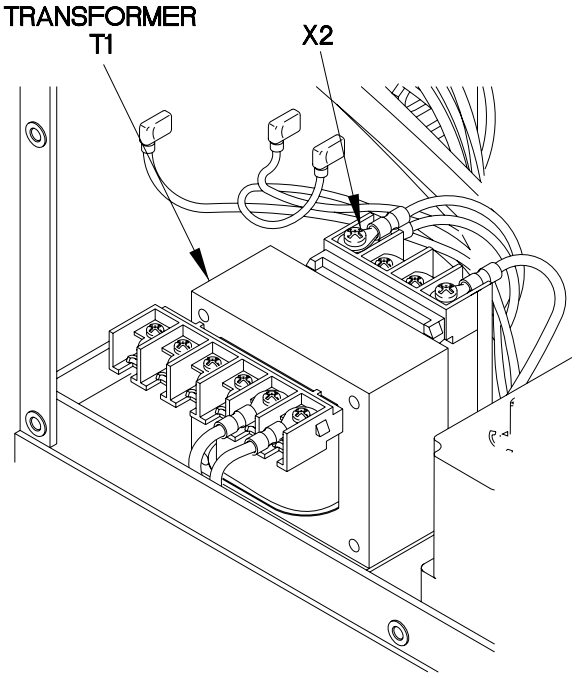


EVAC701A31

ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
17. Is 202-214 VAC present at T1-X2?	No Continue troubleshooting van referencing TM 9-2320-392-20. Yes Go to (Indication/Condition 18).	1. Connect positive (+) probe of digital multimeter to transformer X2. 2. Connect negative (-) probe of digital multimeter to a known good ground. 3. Note reading on digital multimeter.

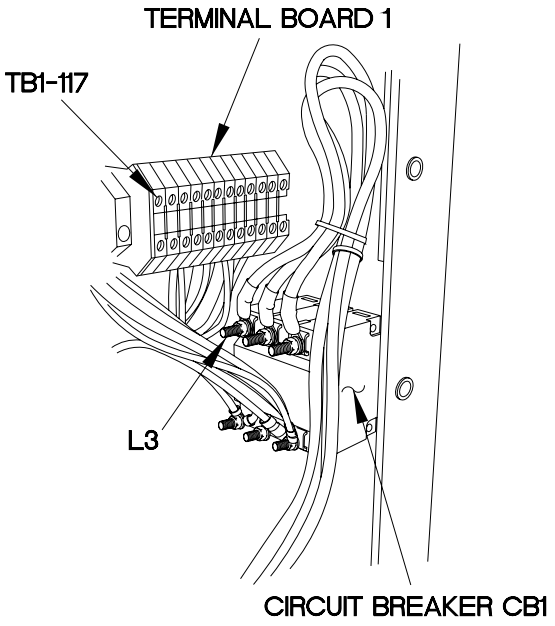


EVAC701A32

ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

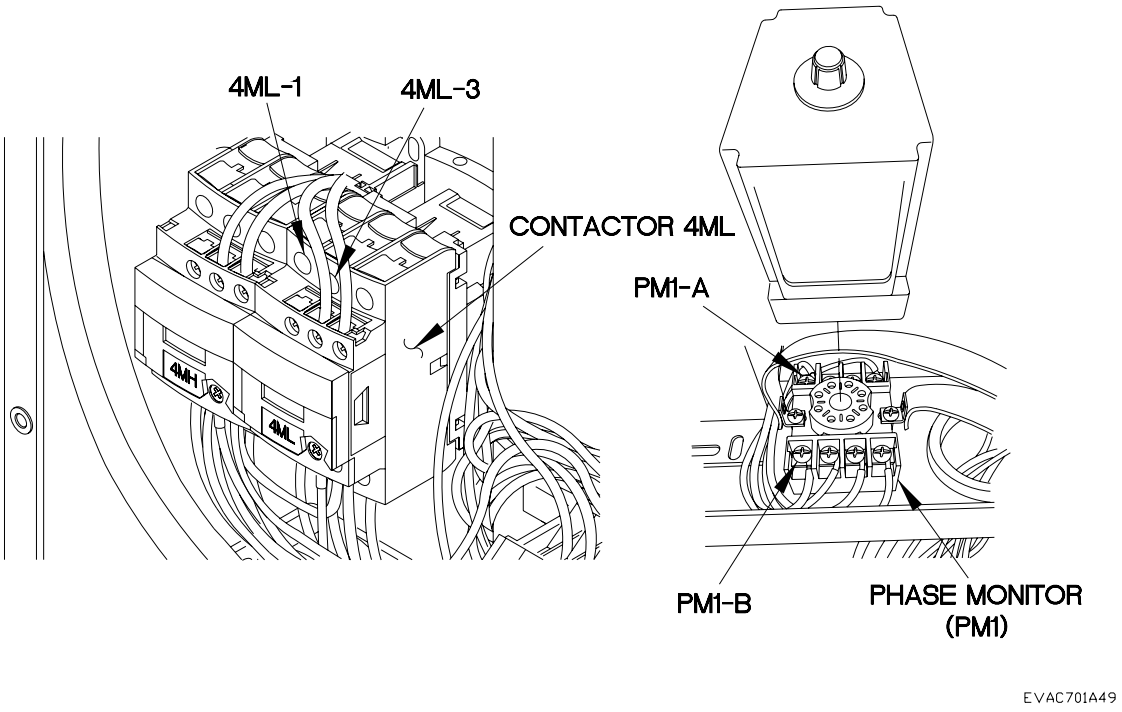
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
18. Is continuity present from TB1-117 to CB1-L3?	No Repair wire (TM 9-2320-391-20) or replace bypass solenoid (Chapter 6.7). Yes Go to (Indication/Condition 19).	1. Shut off power (Chapter 6.25). 2. Connect positive (+) probe of digital multimeter to terminal board TB1-117.
		3. Connect negative (-) probe of digital multimeter to circuit breaker CB1-L3. 4. Note reading on digital multimeter.



ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

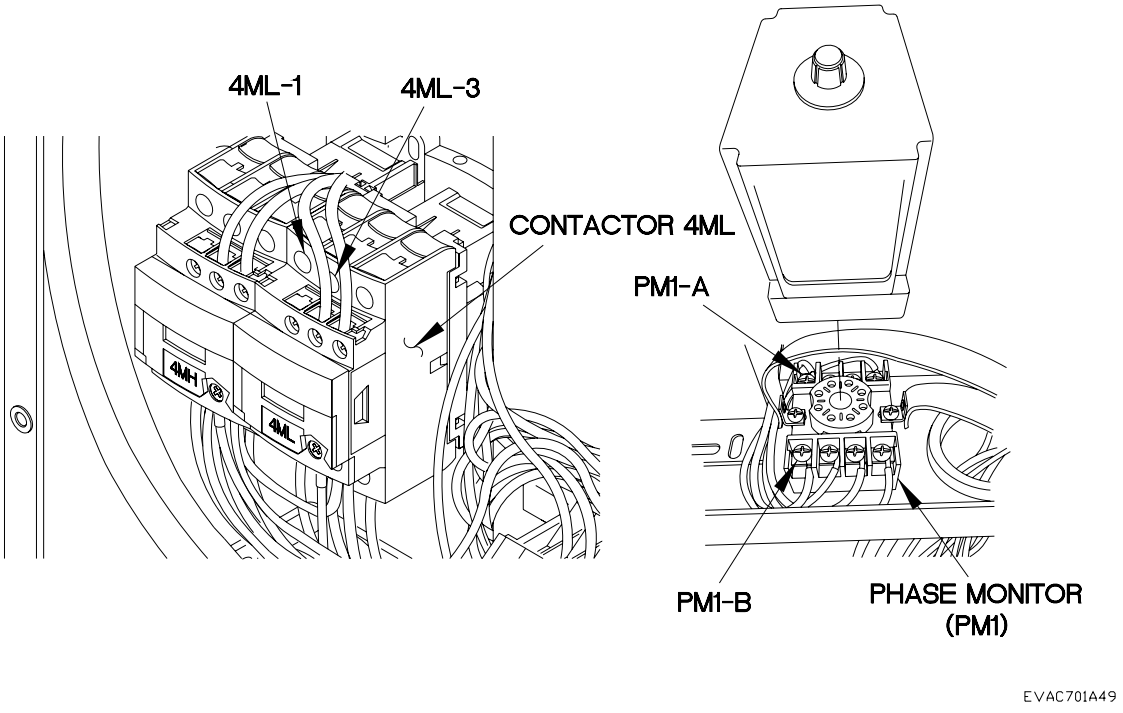
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
19. Is continuity present from phase monitor PM1-A to low speed contactor 4ML-1?	No Repair wire (TM 9-2320-391-20).	1. Connect positive (+) probe of digital multimeter to phase monitor PM1-A.
	Yes Go to (Indication/Condition 20).	2. Connect negative (-) probe of digital multimeter to low speed contactor 4ML-1.
		3. Note reading on digital multimeter.



ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

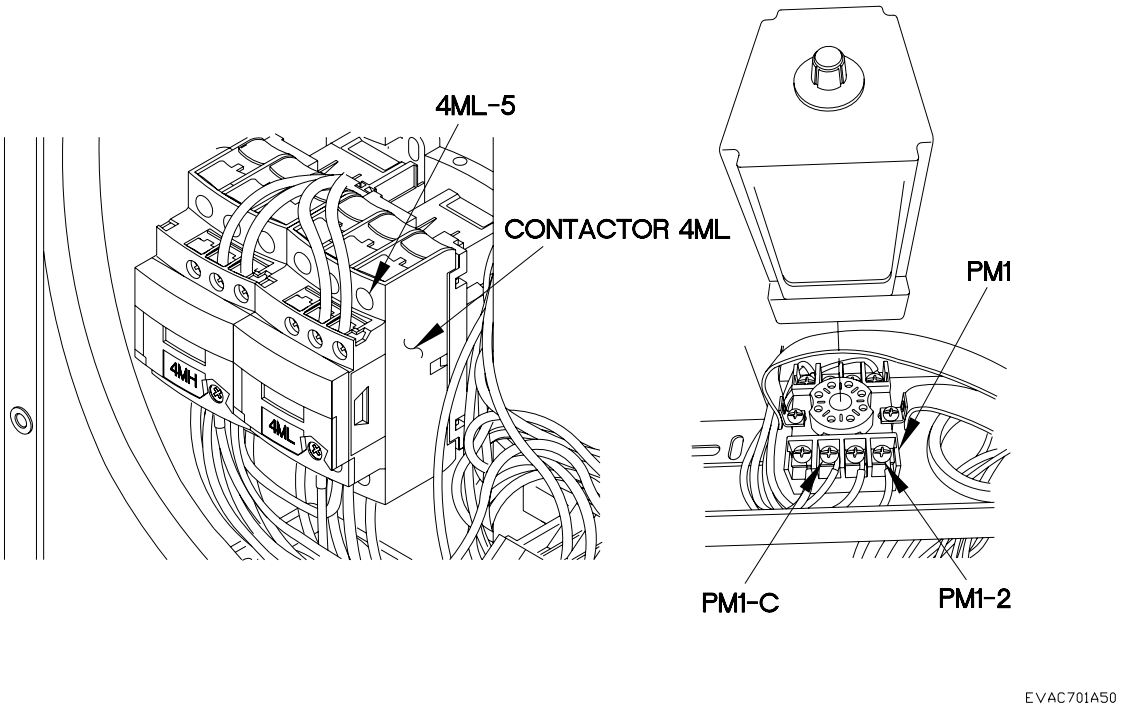
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
20. Is continuity present from phase monitorPM1-B to low speed contactor 4ML-3?	No Repair wire (TM 9-2320-391-20). Yes Go to (Indication/Condition 21).	1. Connect positive (+) probe of digital multimeter to phase monitor PM-B. 2. Connect negative (-) probe of digital multimeter to low speed contactor 4ML-3. 3. Note reading on digital multimeter.



ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

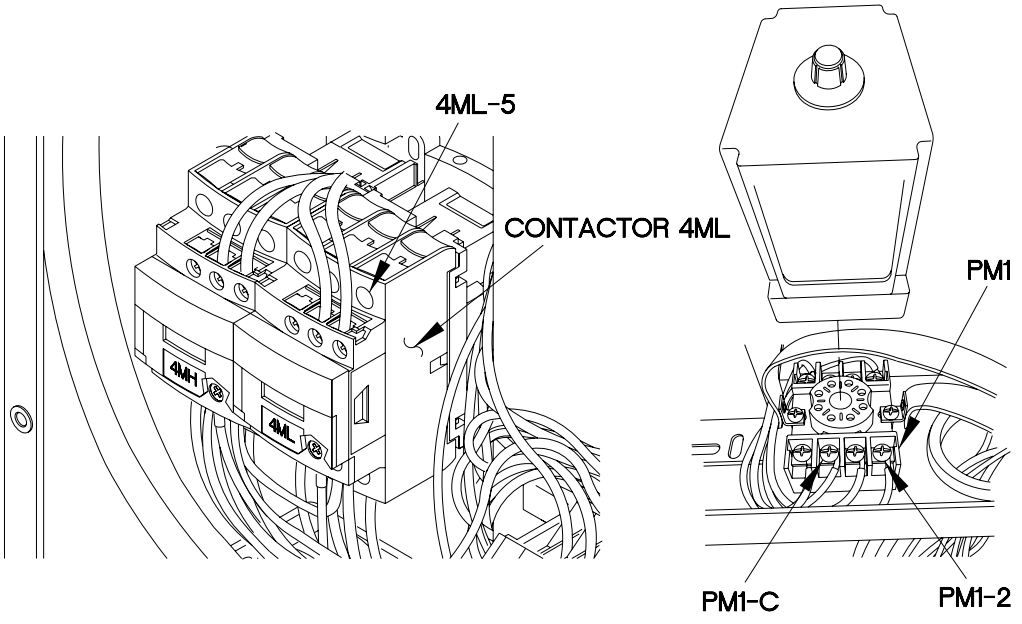
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
21. Is continuity present from phase monitor PM1-C to low speed contactor 4ML-5?	No Repair wire (TM 9-2320-391-20).	1. Connect positive (+) probe of digital multimeter to phase monitor PM1-C
	Yes Go to (Indication/Condition 22).	2. Connect negative (-) probe of digital multimeter to phase contactor 4ML-5.
		3. Note reading on digital multimeter.



ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

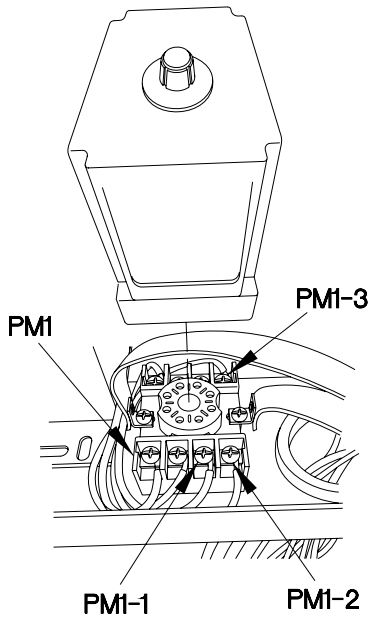
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
22. Is 18-30 VAC present at phase monitor PM1-2?	No Repair wire (TM 9-2320-391-20).	1. Turn on AC (Chapter 5).
	Yes Go to (Indication/Condition 23).	2. Connect positive (+) probe of digital multimeter to phase monitor PM1-2.
		3. Connect negative (-) probe of digital multimeter to a known good ground.
		4. Note reading on digital multimeter.



EVAC701A50

ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

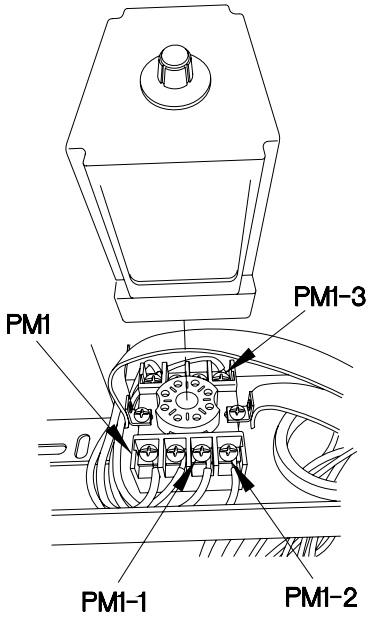
Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
23. Is continuity present from phase monitor PM1-1 to PM1-2?	No Replace phase monitor PM1 (Chapter 6.23). Yes Go to (Indication/Condition 24).	1. Connect positive (+) probe of digital multimeter to phase monitor PM1-1. 2. Connect negative (-) probe of digital multimeter to phase monitor PM1-2.
		 EVAC701A51
		3. Note reading on digital multimeter.

ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
24. Is 18-30 VAC present from phase monitor PM1-2 to PM1-3?	No Replace phase monitor PM1 (Chapter 6.23). Yes Go to (Indication/Condition 25).	1. Connect positive (+) probe of digital multimeter to phase monitor PM1-2. 2. Connect negative (-) probe of digital multimeter to phase monitor PM1-3. 3. Note reading on digital multimeter.

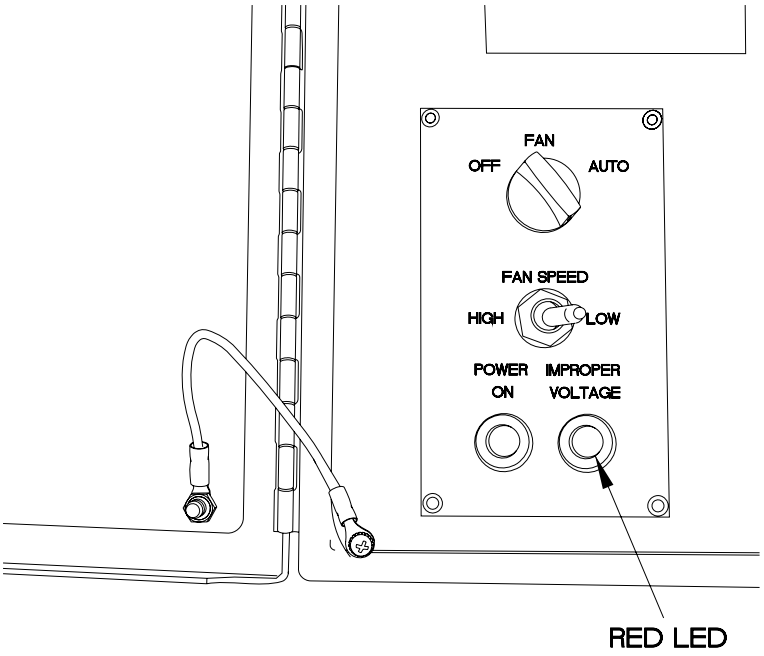


EVAC701A51

ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
25. Is red LED on in control box?	No Go to (Indication/Condition 27). Yes Go to (Indication/Condition 26).	1. Open remote control box lid. 2. Check to see if red LED is illuminated.

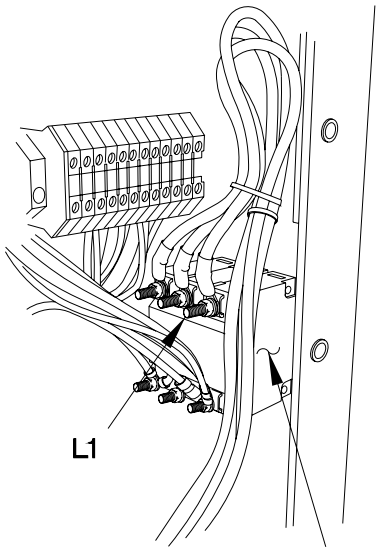


EVAC701A52

ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
26. Is 190-208 VAC present at CB1-L1?	No Go to (Indication/Condition 27). Yes Replace phase monitor PM1 (Chapter 6.23).	1. Apply power (Chapter 6.25). 2. Set digital multimeter to VAC. 3. Connect positive (+) probe of multimeter to circuit breaker CB1-L1.
		4. Connect negative (-) probe of digital multimeter to a known good ground. 5. Note reading on digital multimeter.



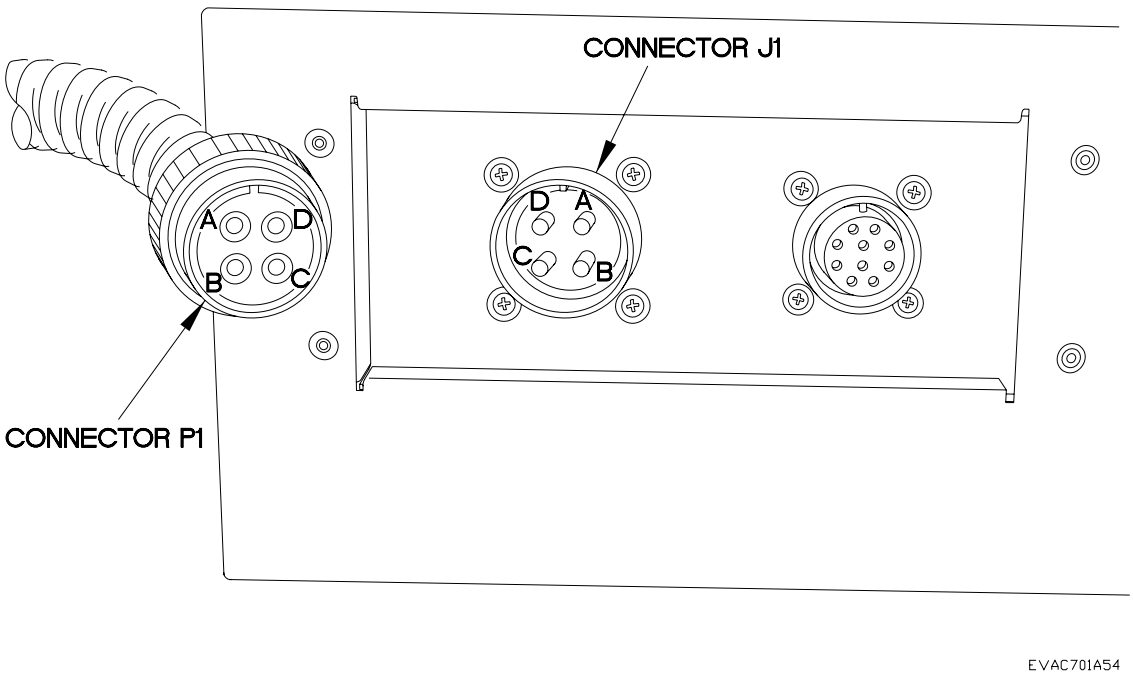
CIRCUIT BREAKER CB1

EVAC701A53

ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
27. Is 190-208 VAC present at connector J1-C?	No Continue troubleshooting in TM 9-2320-392-20. Yes Repair wire L3 (TM 9-2320-391-20).	1. Turn off power (Chapter 5). 2. Turn circuit breaker CB25 OFF. 3. Disconnect connector J1 from connector P1.
		4. Turn on power (Chapter 6.25). 5. Connect positive (+) probe of digital multimeter to connector J1-C. 6. Connect negative (-) probe of digital multimeter to a known good ground.



COMPRESSOR DOES NOT START 7.2

THIS WORK PACKAGE COVERS:
ECU System Troubleshooting

INITIAL SETUP:

Maintenance Level
Field

Tools/Special Tools
Tool Kit, Genl Mech (NSN 5180-01-454-3787)
Multimeter (NSN 6625-01-139-2512)

Materials/Parts
Ties, Cable, Plastic (NSN 5975-01-379-4997)
Wire, Electrical 50 ft (NSN 6145-01-148-2263)

References
TM 9-2320-391-20 FMTV IETM (Electrical Wire and Cable Repair)

Personnel Required
Two

Equipment Conditions
AC panels removed (Chapter 6.24)

PROCEDURE

WARNING

Remove rings, bracelets, watches, necklaces, and any other jewelry before working around vehicle. Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Failure to comply may result in injury to personnel.

CAUTION

Use care when testing electrical connectors. Do not damage connector pins or sockets with multimeter probes. Failure to comply may result in damage to equipment.

NOTE

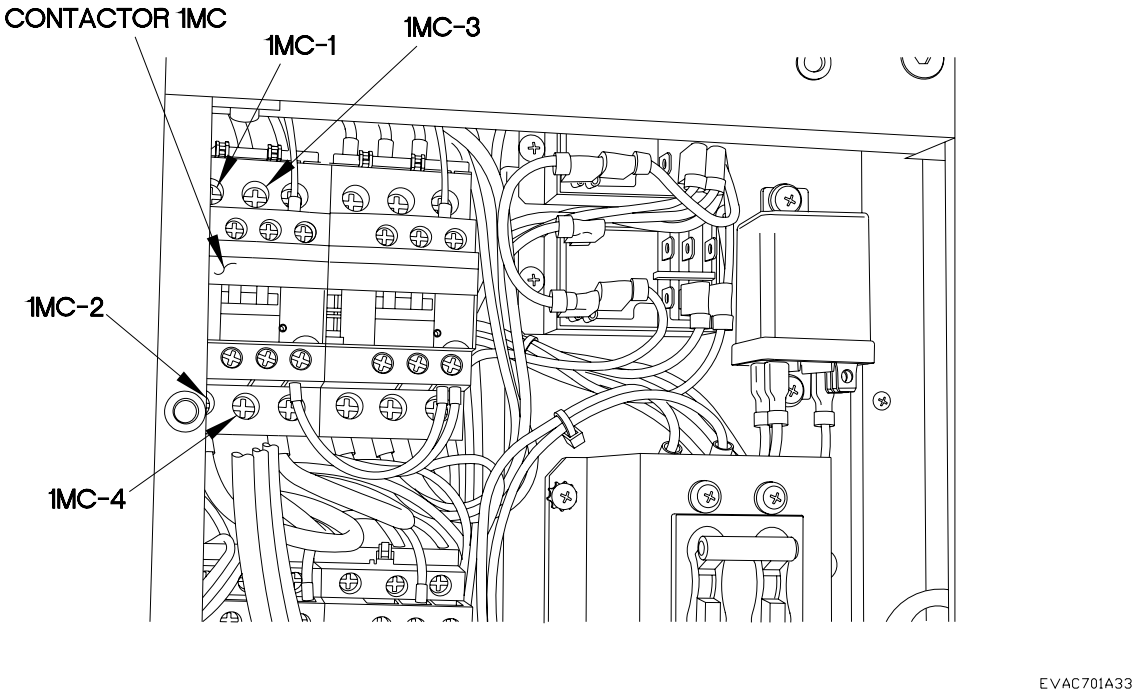
Refer to Refrigerant schematic as required.

Tag hoses and connection points prior to disconnecting.

Remove plastic cable ties as required.

ECU SYSTEM TROUBLESHOOTING - Continued

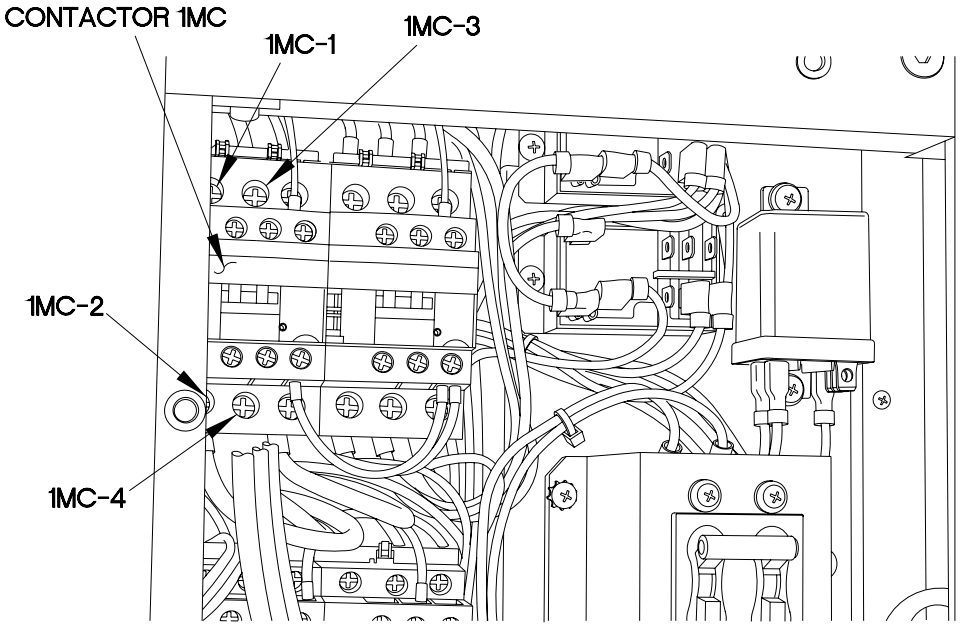
Table 1. ECU System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
1. Is continuity present across contactor 1MC?	No Go to (Indication/Condition 2). Yes Replace contactor 1MC (Chapter 6.16).	1. Turn off power (Chapter 5). 2. Set multimeter to ohms. 3. Connect positive (+) probe of digital multimeter to connector 1MC-1. 4. Connect negative (-) probe of digital multimeter to connector 1MC-2.  5. Note reading on digital multimeter.

ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
1. Is continuity present across contactor 1MC?-Continued	No Go to (Indication/Condition 2).	6. Connect positive (+) probe of digital multimeter to 1MC-3.
	Yes Replace contactor 1MC (Chapter 6.16).	7. Connect negative (-) probe of digital multimeter to iMC-4.
		8. Note reading on digital multimeter.

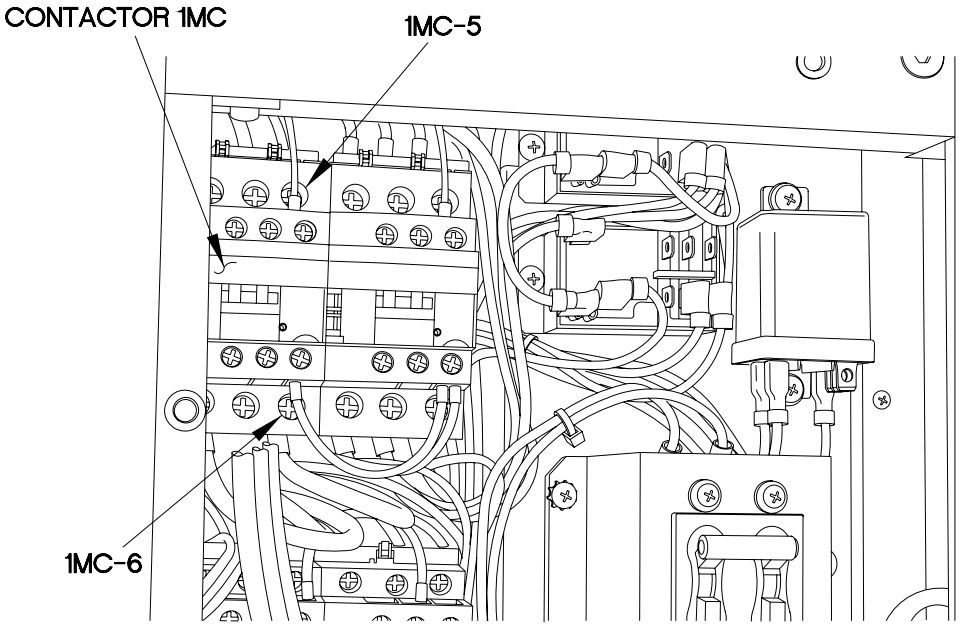


EVAC701A33

ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
1. Is continuity present across contactor 1MC?-Continued	No Go to (Indication/Condition 2).	9. Connect positive (+) probe of digital multimeter to contactor 1MC-5.
	Yes Replace contactor 1MC (Chapter 6.16).	10. Connect negative (-) probe of digital multimeter to contactor 1MC-6.
		11. Note reading on digital multimeter.

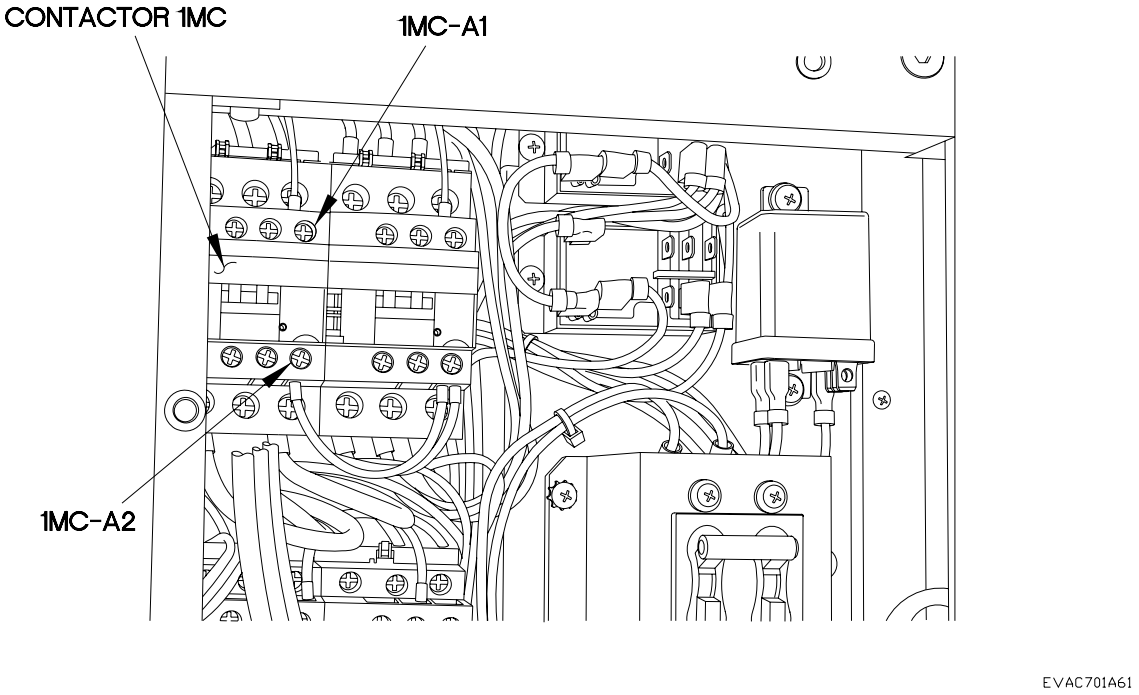


EVAC701A60

ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

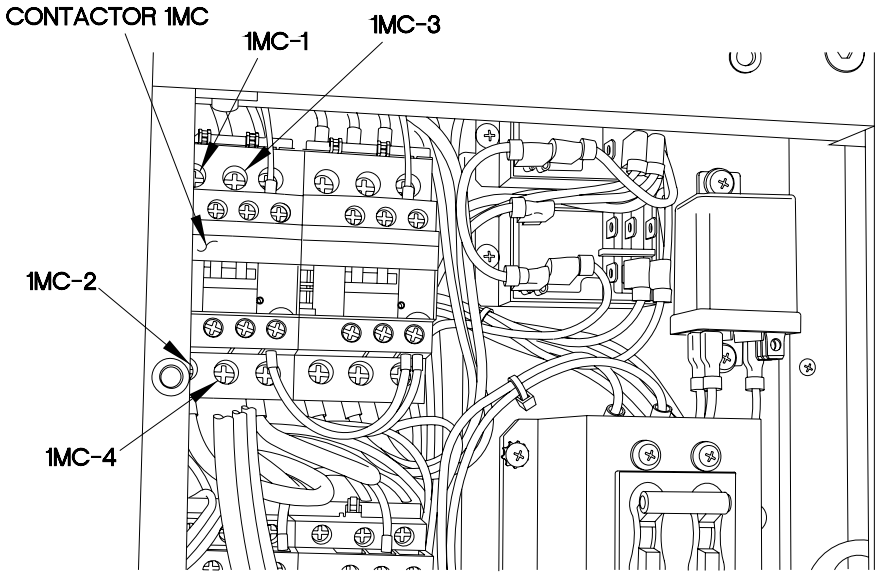
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
2. Is continuity present across contactor 1MC-A1 to 1MC-A2?	No Replace contactor 1MC (Chapter 6.16). Yes Go to (Indication/Condition 3).	1. Connect positive (+) probe of digital multimeter to contactor 1MC-A1. 2. Connect negative (-) probe of digital multimeter to contactor 1MC-A2. 3. Note reading on digital multimeter.



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
3. Is continuity present across contactor 1MC with power applied?	No Replace contactor 1MC (Chapter 6.16).	1. Apply power (Chapter 5).
	Yes Go to (Indication/Condition 4).	2. Connect positive (+) probe of digital multimeter to contactor 1MC-1. 3. Connect negative (-) probe of digital multimeter to contactor 1MC-2. 4. Note reading on digital multimeter. 5. Connect positive (+) probe of digital multimeter to contactor 1MC-3. 6. Connect negative (-) probe of digital multimeter to contactor 1MC-4. 7. Note reading on digital multimeter.



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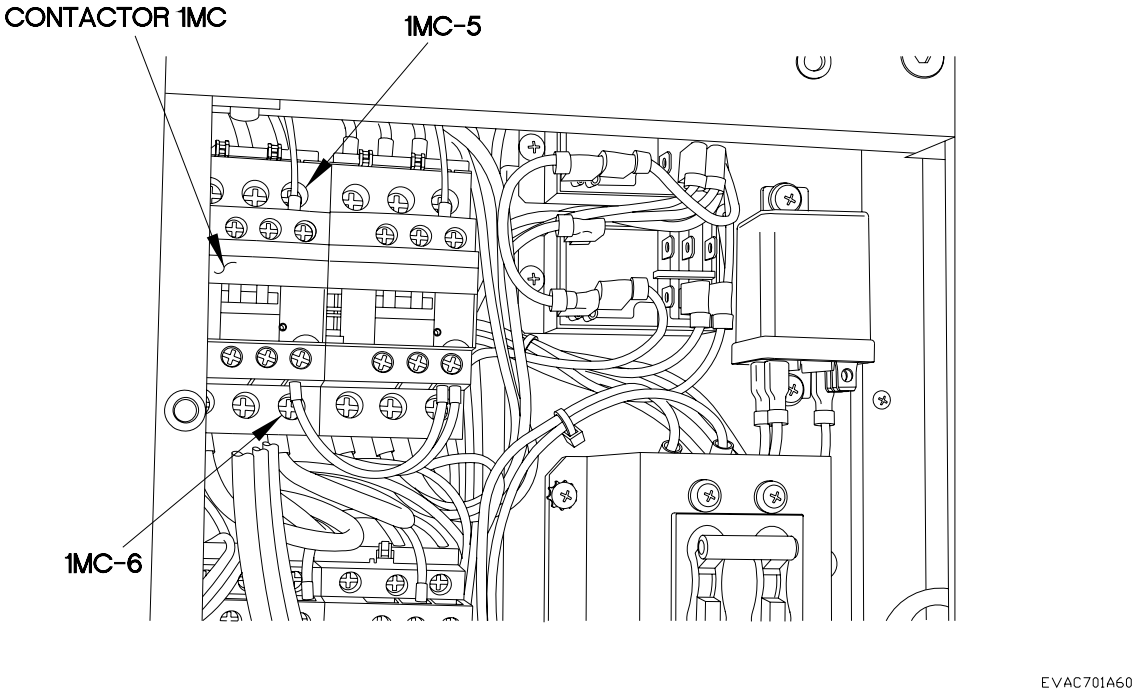
ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

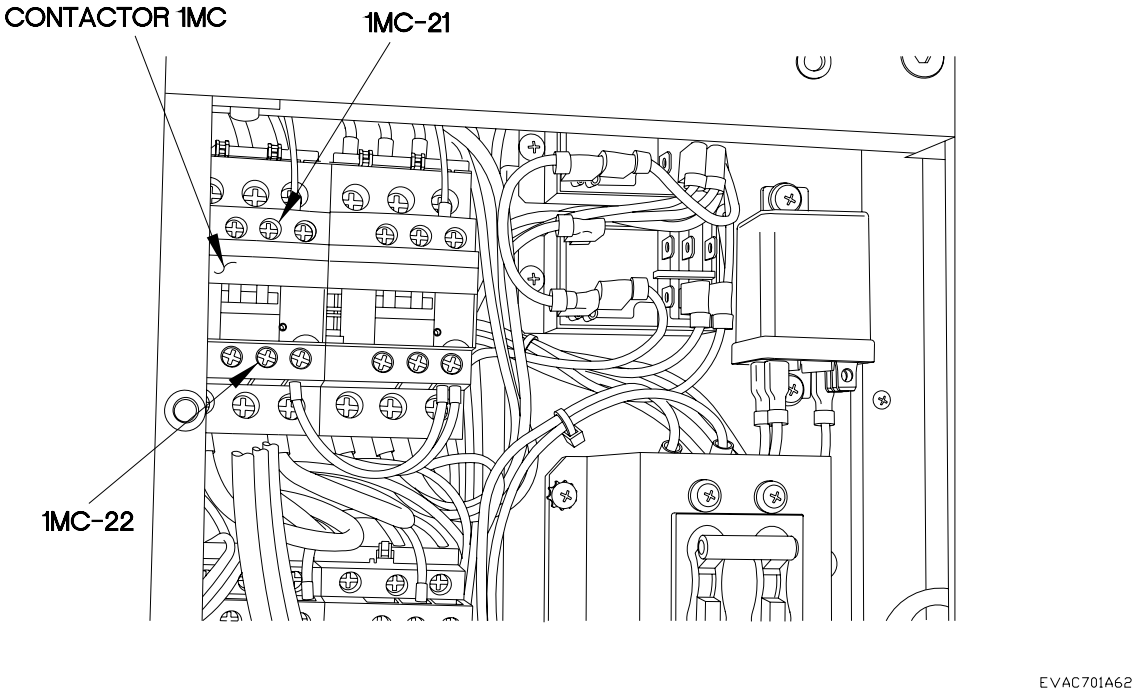
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
3. Is continuity present across contactor 1MC with power applied?-Continued	No Replace contactor 1MC (Chapter 6.16). Yes Go to (Indication/Condition 4).	8. Connect positive (+) probe of digital multimeter to contactor 1MC-5. 9. Connect negative (-) probe of digital multimeter to contactor 1MC-6. 10. Note reading on digital multimeter.



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

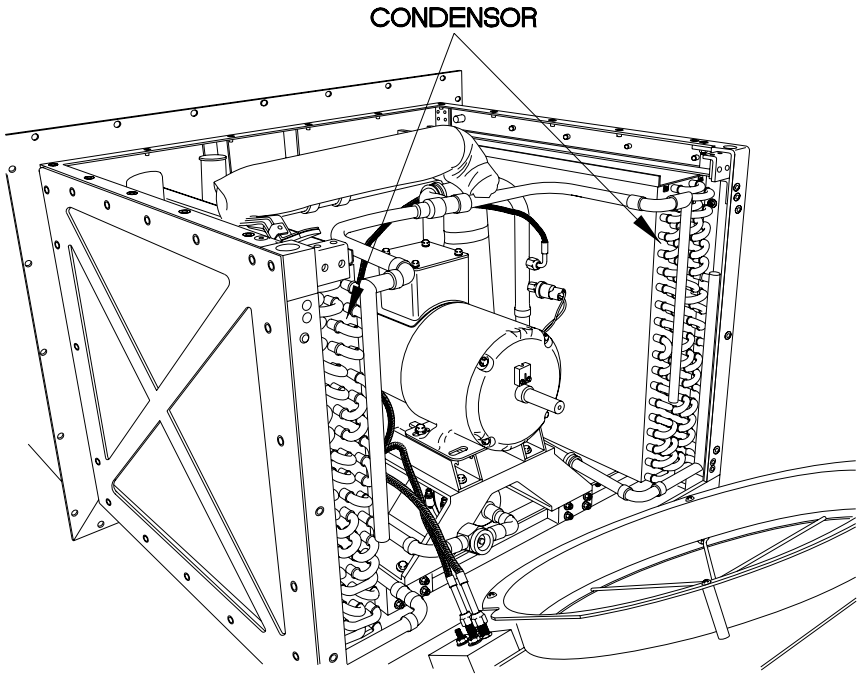
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
4. Is continuity present across contactor 1MC-21 to 1MC-22?	No Go to (Indication/Condition 5). Yes Replace contactor 1MC (Chapter 6.16).	1. Connect positive (+) probe of digital multimeter to contactor1MC-21. 2. Connect negative (-) probe of digital multimeter to contactor 1MC-22. 3. Note reading on digital multimeter.



ECU SYSTEM TROUBLESHOOTING - Continued

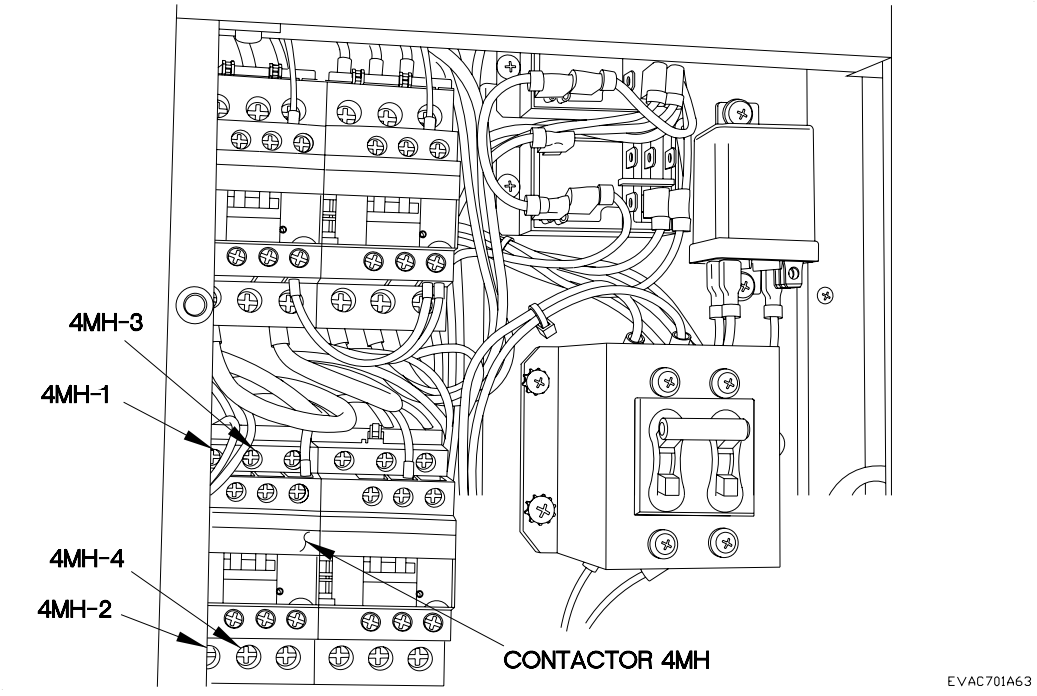
Table 1. ECU System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
5. Are the condensers free from debris or blockage?	No Go to (Indication/Condition 6). Yes Clean condenser (EM 0195).	1. Check condenser for debris or blockage.



ECU SYSTEM TROUBLESHOOTING - Continued

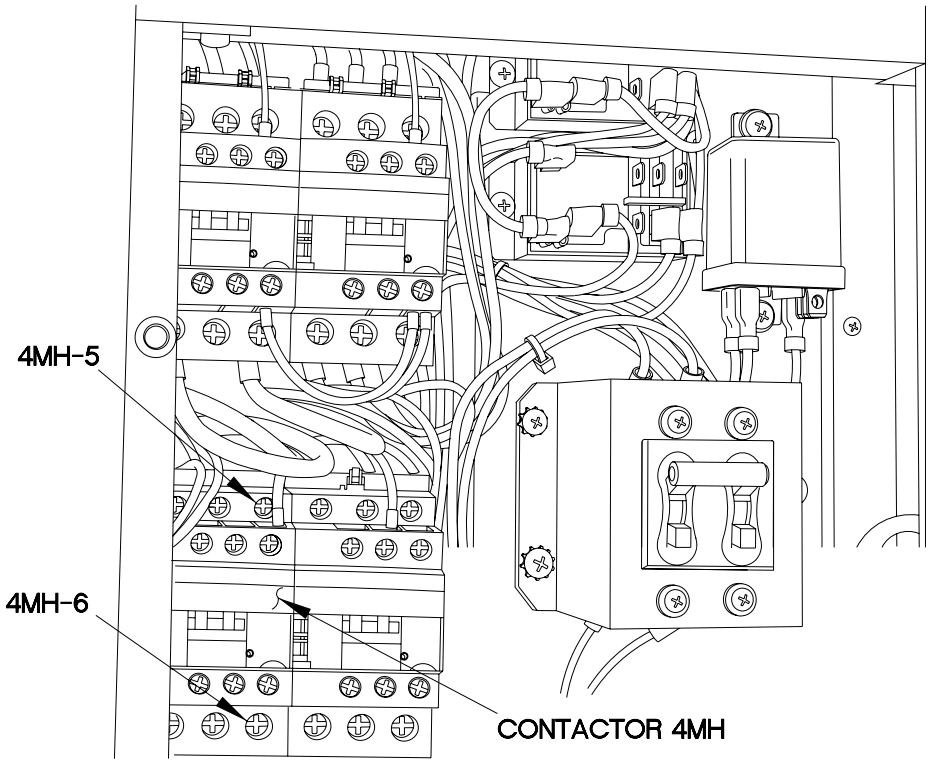
Table 1. ECU System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
6. Is continuity present across contactor 4MH?	No Go to (Indication/Condition 7). Yes Replace contactor 4MH (Chapter 6.16).	1. Shut off power (Chapter 5). 2. Connect positive (+) probe of digital multimeter to contactor 4MH-1. 3. Connect negative (-) probe of digital multimeter to contactor 4MH-2. 4. Note reading on digital multimeter. 5. Connect positive (+) probe of digital multimeter to contactor 4MH-3.  6. Connect negative (-) probe of digital multimeter to contactor 4MH-4. 7. Note reading on digital multimeter.

ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

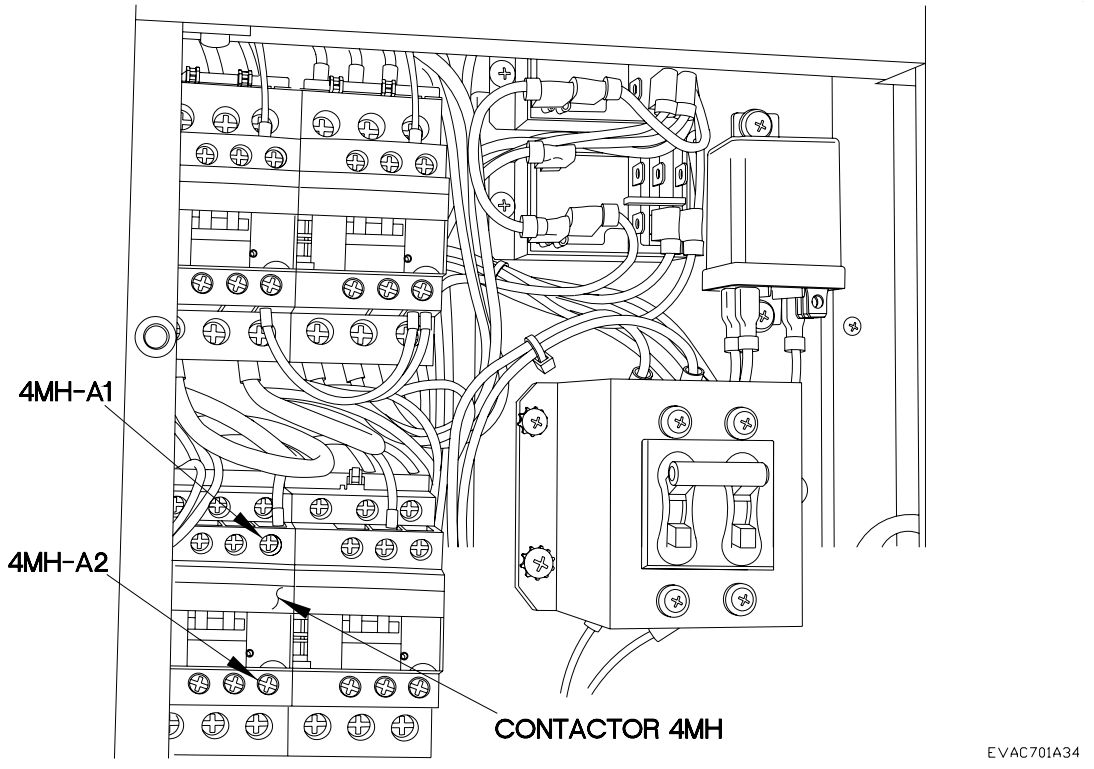
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
6. Is continuity present across contactor 4MH?-Continued	No Go to (Indication/Condition 7). Yes Replace contactor 4MH (Chapter 6.16).	8. Connect positive (+) probe of digital multimeter to contactor 4MH-5. 9. Connect negative (-) probe of digital multimeter to contactor 4MH-6. 10. If continuity is present, replace contactor 4MH (Chapter 6.16).



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

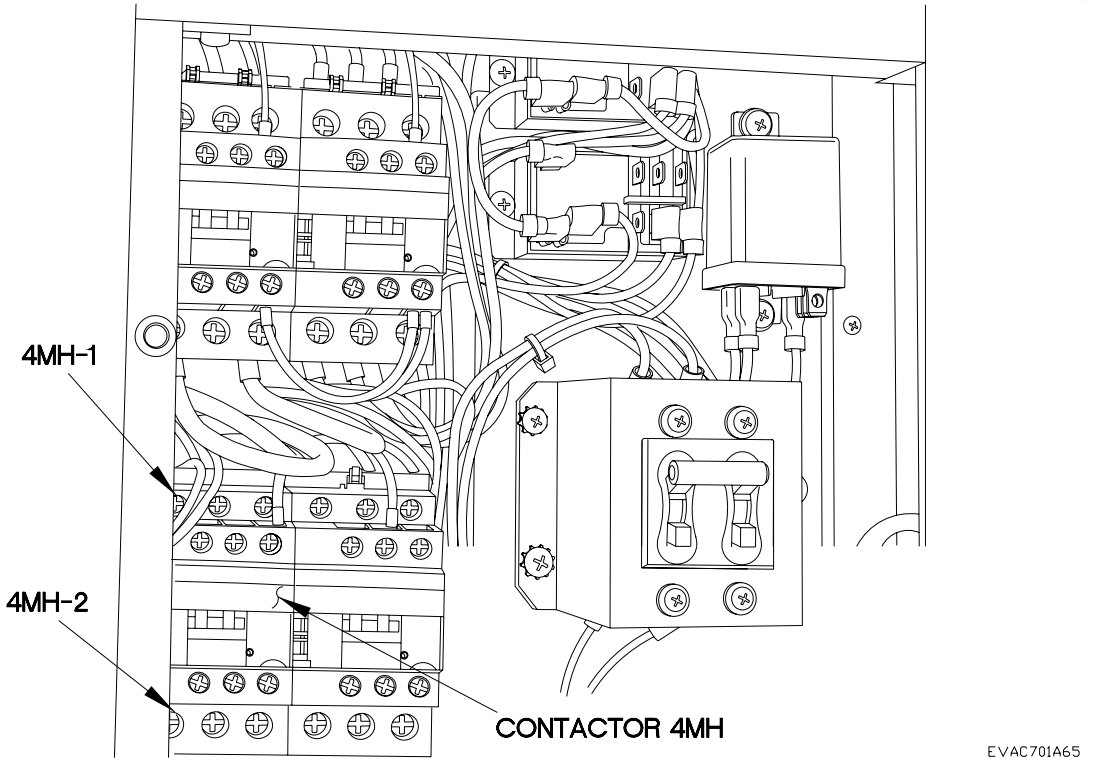
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
7. Is continuity present across contactor 4MH-A1 to 4MH-A2?-Continued	No Replace contactor 4MH (Chapter 6.16). Yes Go to (Indication/Condition 8).	1. Connect positive (+) probe of digital multimeter to contactor 4MH-A1. 2. Connect negative (-) probe of digital multimeter to contactor 4MH-A2. 3. Note reading on digital multimeter.



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

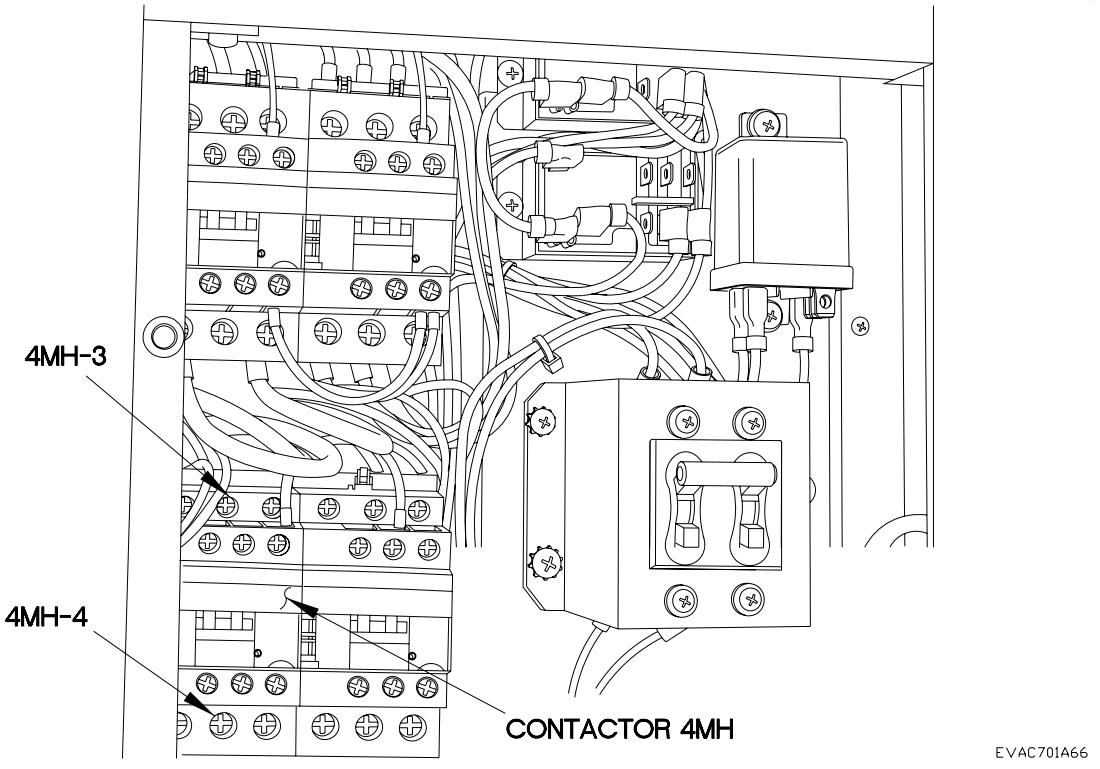
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
8. Is continuity present across contactor 4MH with power applied?	No Replace high speed contactor 4MH (Chapter 6.16). Yes Go to (Indication/Condition 9).	1. Apply power (Chapter 5). 2. Connect positive (+) probe of digital multimeter to contactor 4MH-1. 3. Connect negative (-) probe of digital multimeter to contactor 4MH-2. 4. Note reading on digital multimeter.



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

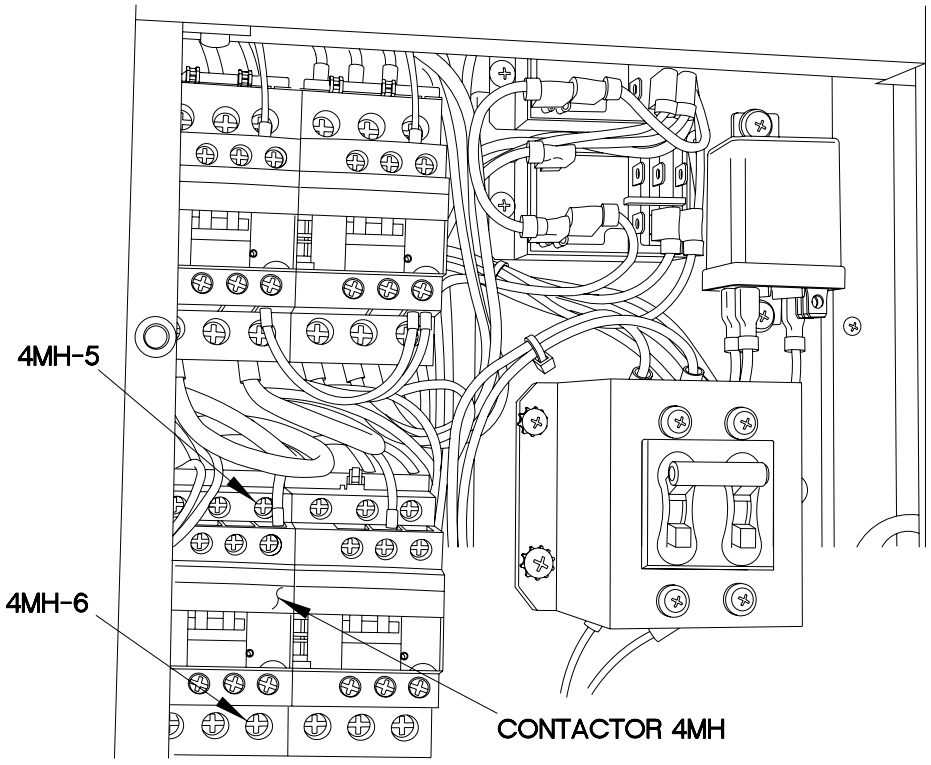
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
8. Is continuity present across contactor 4MH with power applied?-Continued	No Replace high speed contactor 4MH (Chapter 6.16). Yes Go to (Indication/Condition 9).	5. Connect positive (+) probe of digital multimeter to contactor 4MH-3. 6. Connect negative (-) probe of digital multimeter to contactor 4MH-4. 7. Note reading on digital multimeter.



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

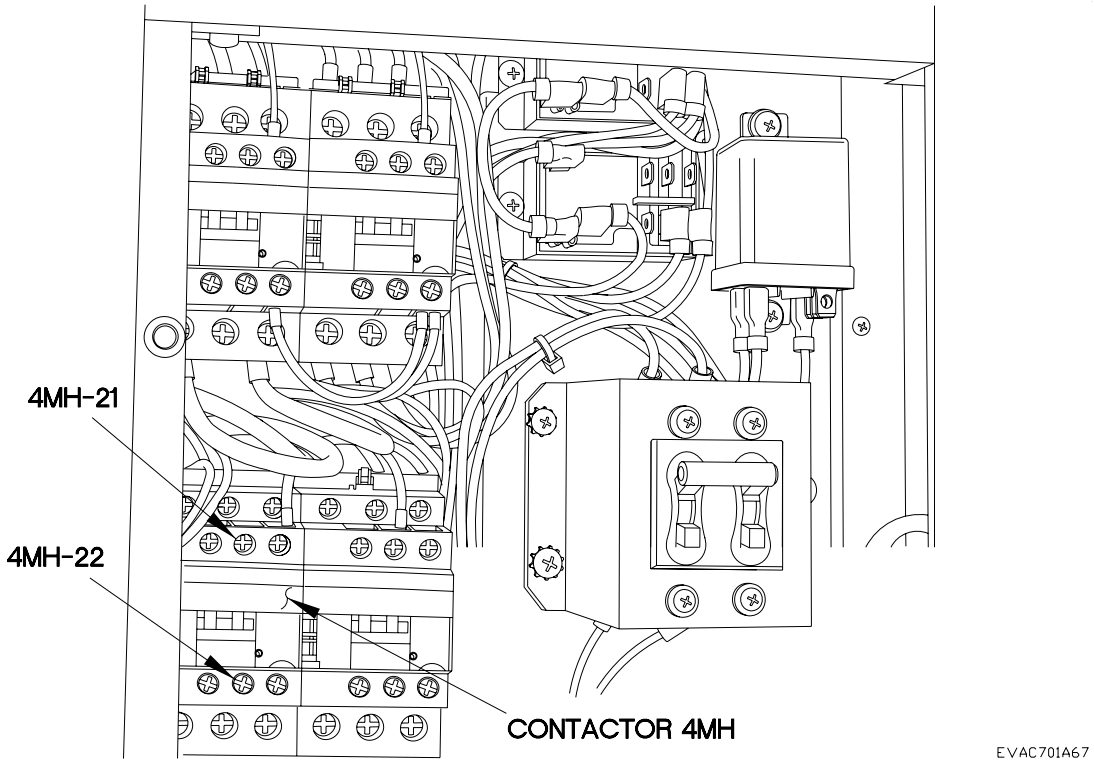
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
8. Is continuity present across contactor 4MH with power applied?-Continued	No Replace high speed contactor 4MH (Chapter 6.16). Yes Go to (Indication/Condition 9).	8. Connect positive (+) probe o digital multimeter to contactor 4MH-5. 9. Connect negative (-) probe of digital multimeter to contactor 4MH-6. 10. Note reading on digital multimeter.



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

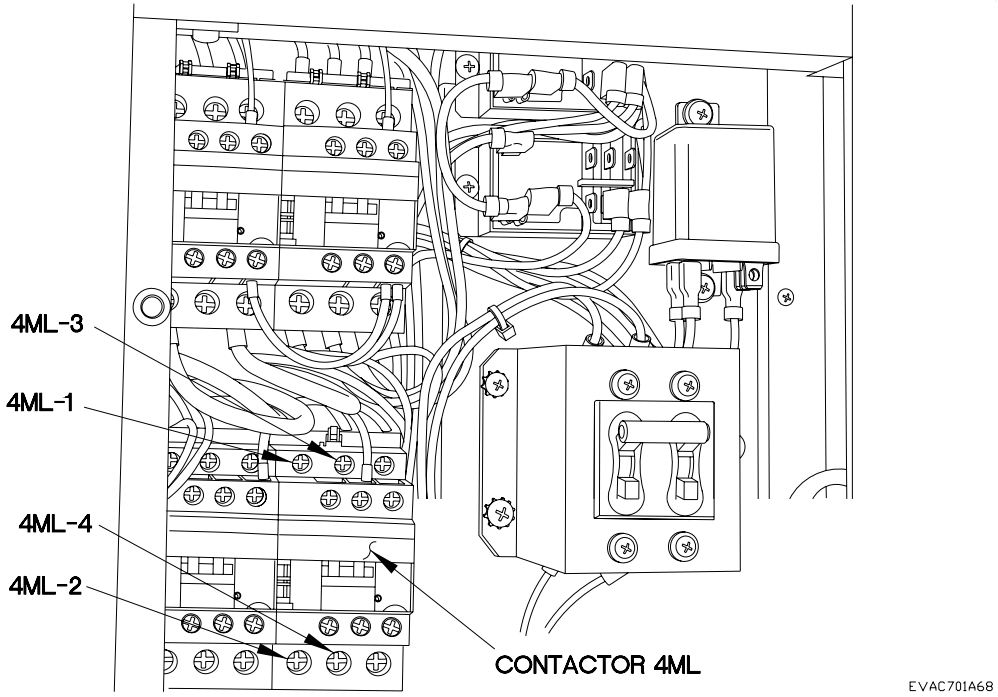
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
9. Is continuity present across contactor 4MH-21 to 4MH-22?	No Go to (Indication/Condition 10). Yes Replace contactor 4MH (Chapter 6.16).	1. Connect positive (+) probe of digital multimeter to contactor 4MH-21. 2. Connect negative (-) probe of digital multimeter to contactor 4MH-22. 3. Note reading on digital multimeter.



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

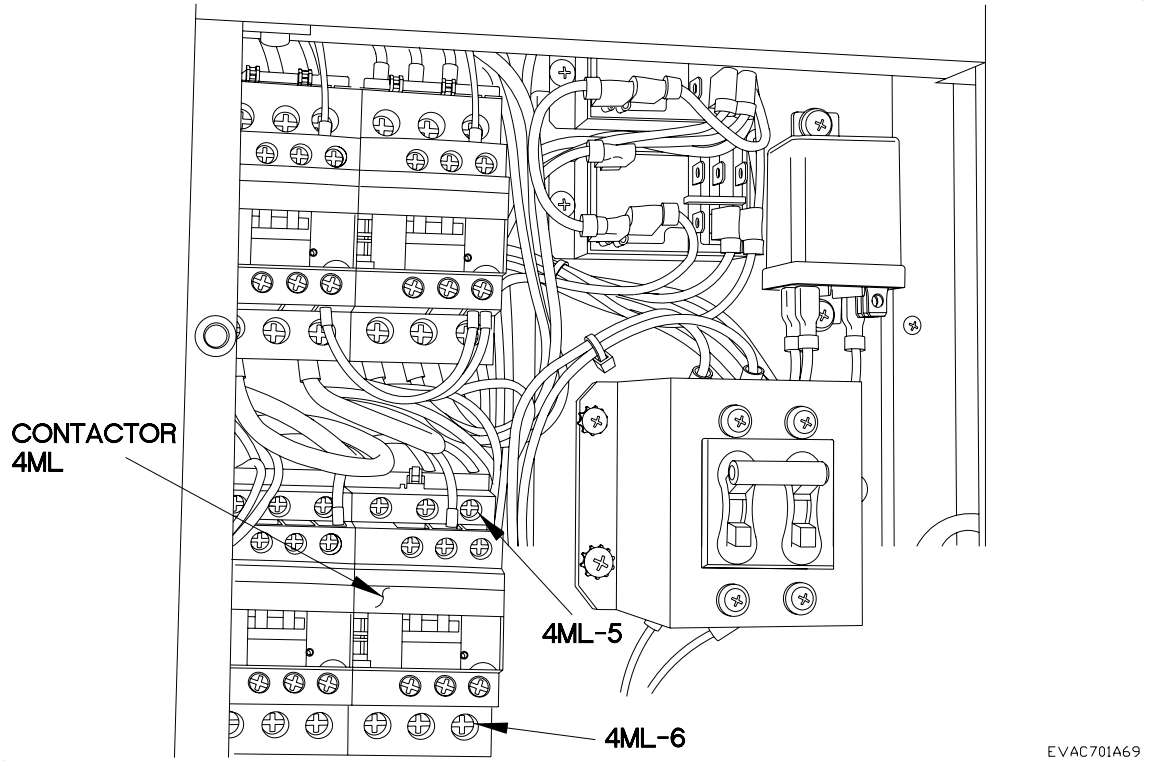
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
10. Is continuity present across contactor 4ML?	No Go to (Indication/Condition 11). Yes Replace contactor 4ML (Chapter 6.16).	1. Turn off power (Chapter 6.25). 2. Connect positive (+) probe of digital multimeter to contactor 4ML-1. 3. Connect negative (-) probe of digital multimeter to contactor 4ML-2. 4. Note reading on digital multimeter. 5. Connect positive (+) probe of digital multimeter to contactor 4ML-3. 6. Connect negative (-) probe of digital multimeter to contactor 4ML-4. 7. Note reading on digital multimeter.



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

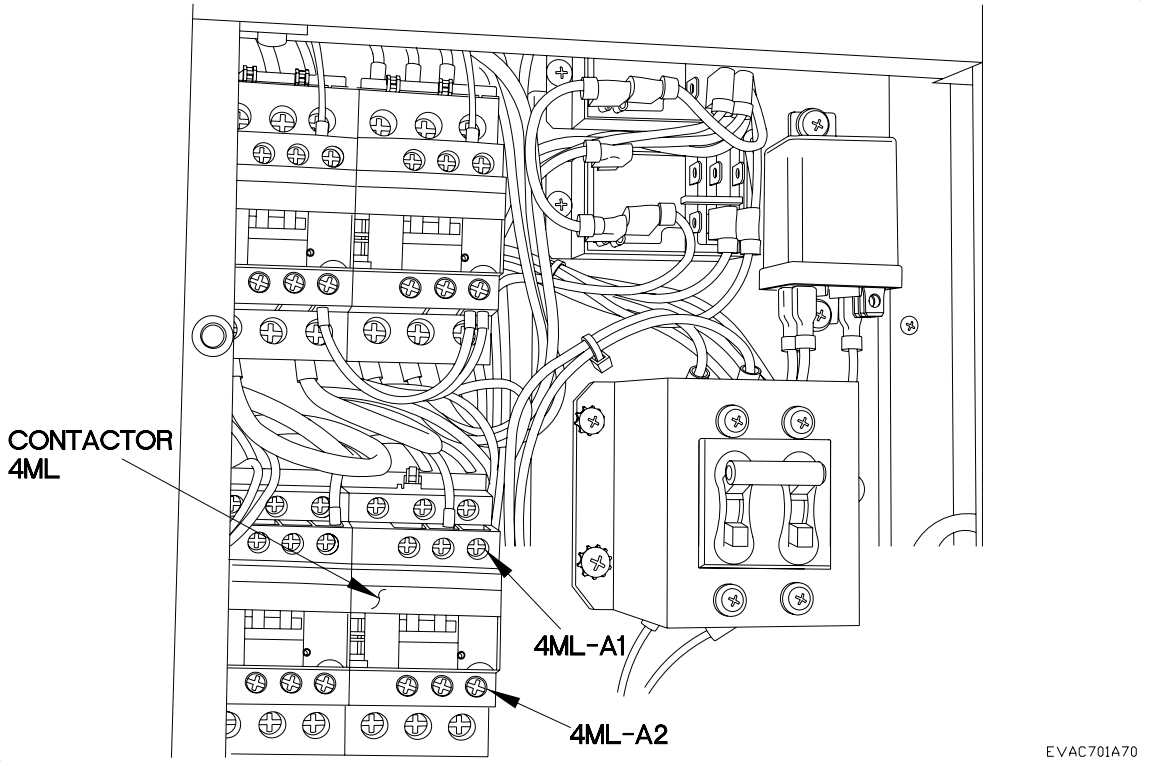
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
10. Is continuity present across contactor 4ML?-Continued	No Go to (Indication/Condition 11). Yes Replace contactor 4ML (Chapter 6.16).	8. Connect positive (+) probe of digital multimeter to contactor 4ML-5. 9. Connect negative (-) probe of digital multimeter to contactor 4ML-6. 10. Note reading on digital multimeter. 11. If continuity is present, replace contactor 4ML (Chapter 6.16).



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

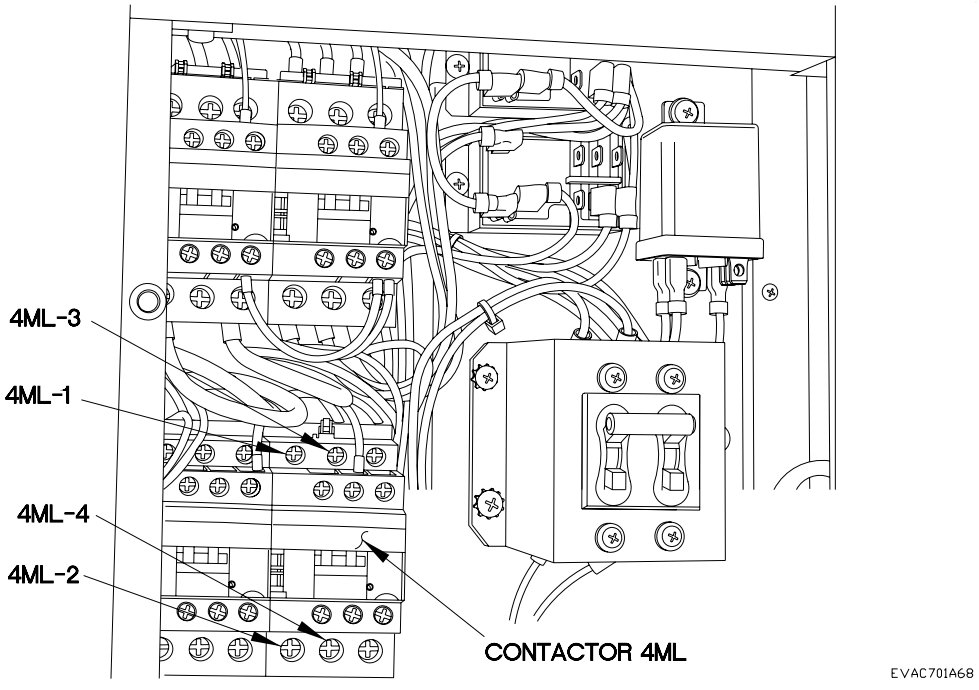
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
11. Is continuity present across contactor 4ML-A1 to 4ML-A2?	No Replace contactor 4ML (Chapter 6.16). Yes Go to (Indication/Condition 12).	1. Connect positive (+) probe of digital multimeter to contactor 4ML-A1. 2. Connect negative (-) probe of digital multimeter to contactor 4ML-A2. 3. If continuity is not present, replace contactor 4ML (Chapter 6.16).



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

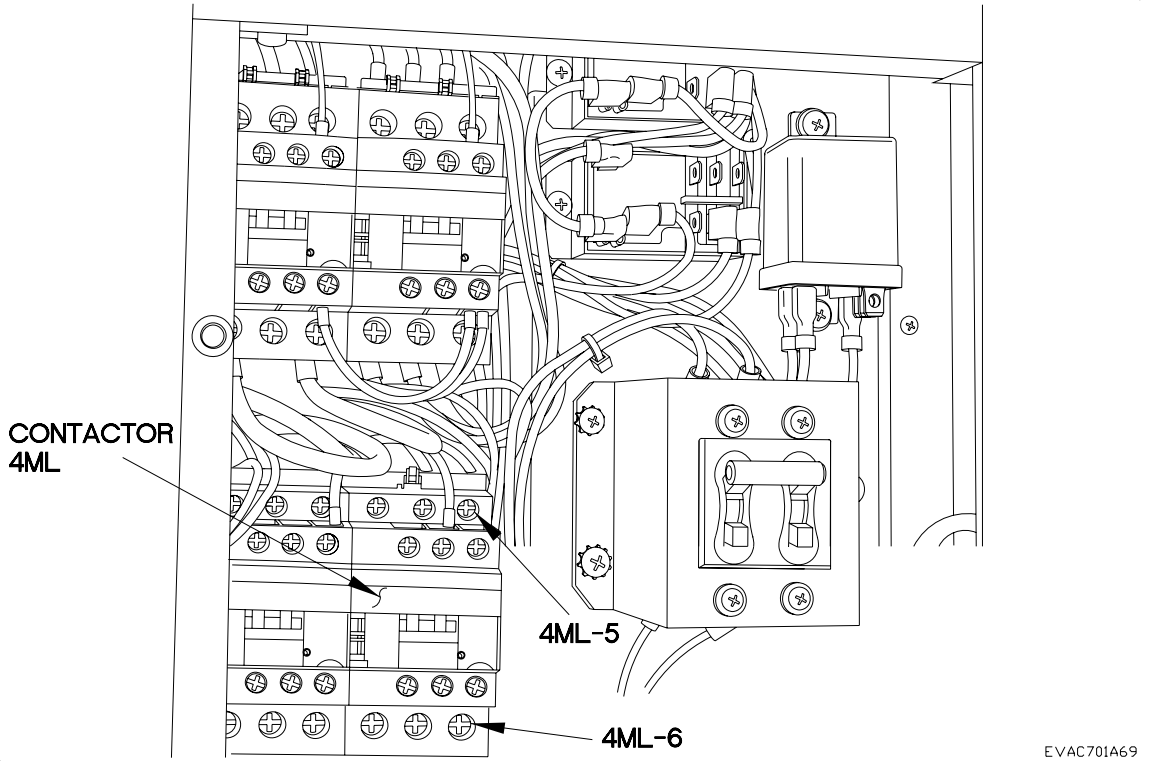
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
12. Is continuity present across contactor 4ML with power applied?	No Replace low speed contactor 4ML (Chapter 6.16). Yes Go to (Indication/Condition 13).	1. Apply power (Chapter 6.25). 2. Connect positive (+) probe of digital multimeter to contactor 4ML-1. 3. Connect negative (-) probe of digital multimeter to contactor 4ML-2. 4. Note reading on digital multimeter. 5. Connect positive (+) probe of digital multimeter to contactor 4ML-3. 6. Connect negative (-) probe of digital multimeter to contactor 4ML-4. 7. Note reading on digital multimeter.



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

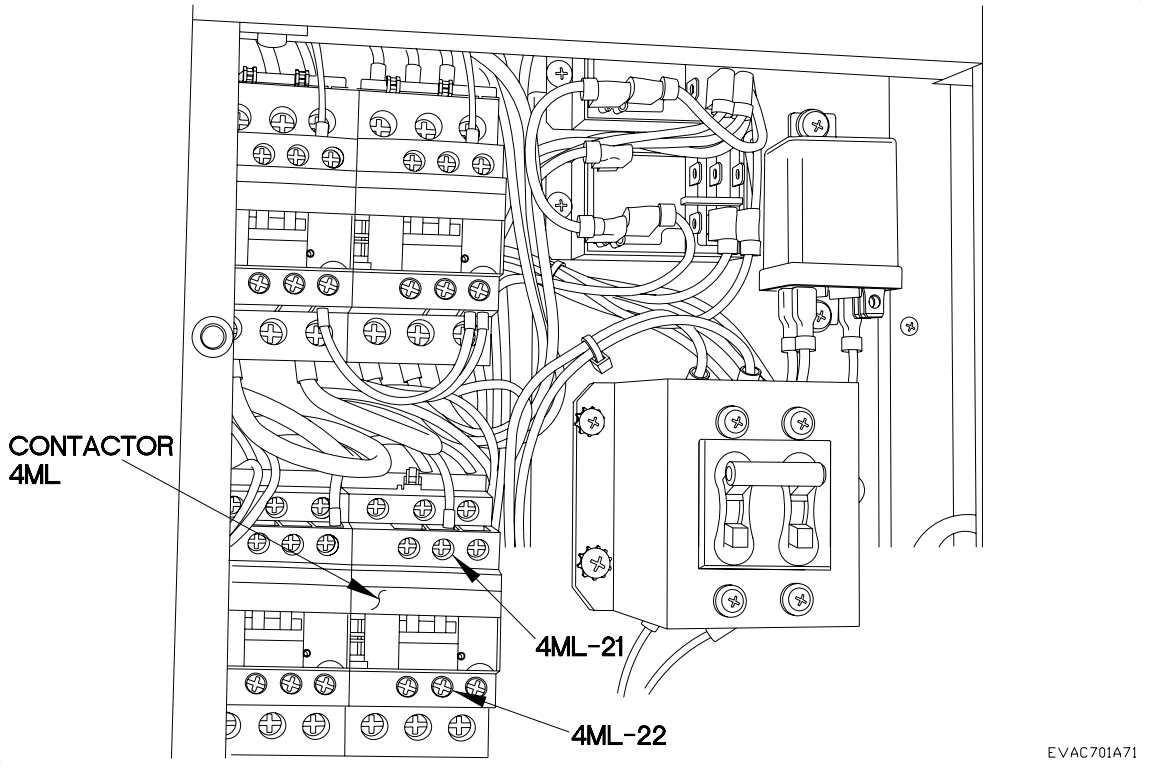
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
12. Is continuity present across contactor 4ML with power applied?-Continued	No Replace low speed contactor 4ML (Chapter 6.16). Yes Go to (Indication/Condition 13).	8. Connect positive (+) probe of digital multimeter to contactor 4ML-5. 9. Connect negative (-) probe of digital multimeter to contactor 4ML-6. 10. Note reading on digital multimeter. 11. If continuity is not present, replace low speed contactor 4ML (Chapter 6.16).



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

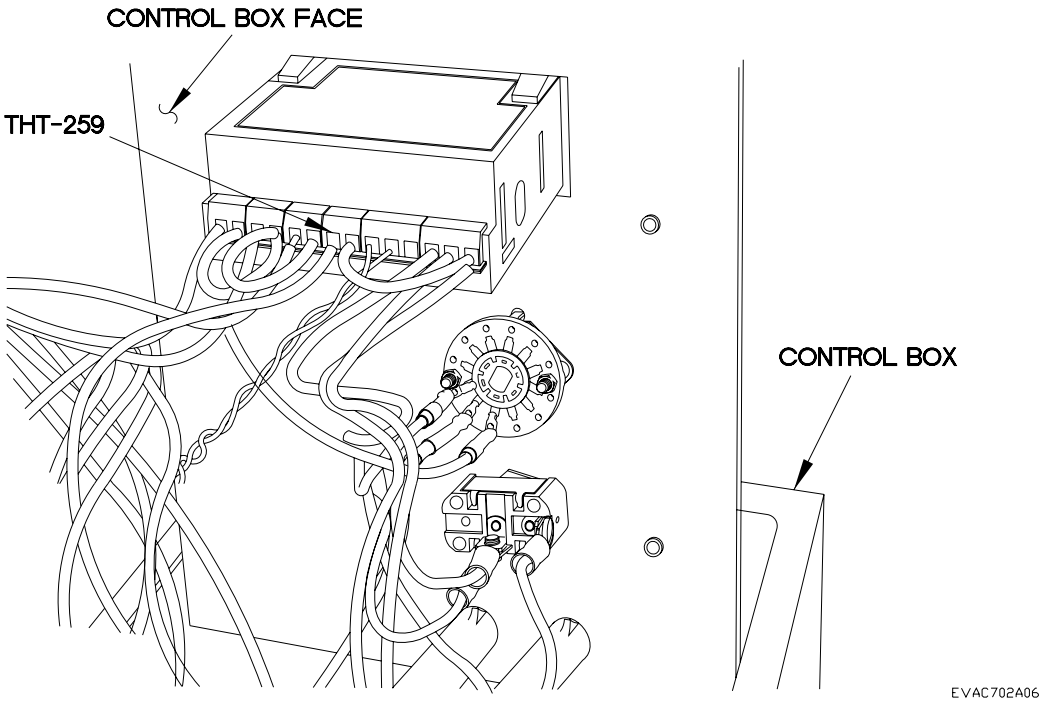
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
13. Is continuity present across contractor 4ML-21 to 4ML-22?	No Go to (Indication/Condition 14). Yes Replace low speed contactor 4ML (Chapter 6.16).	1. Connect positive (+) probe of digital multimeter to contactor 4ML-21. 2. Connect negative (-) probe of digital multimeter to contactor 4ML-22. 3. Note reading on digital multimeter.



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

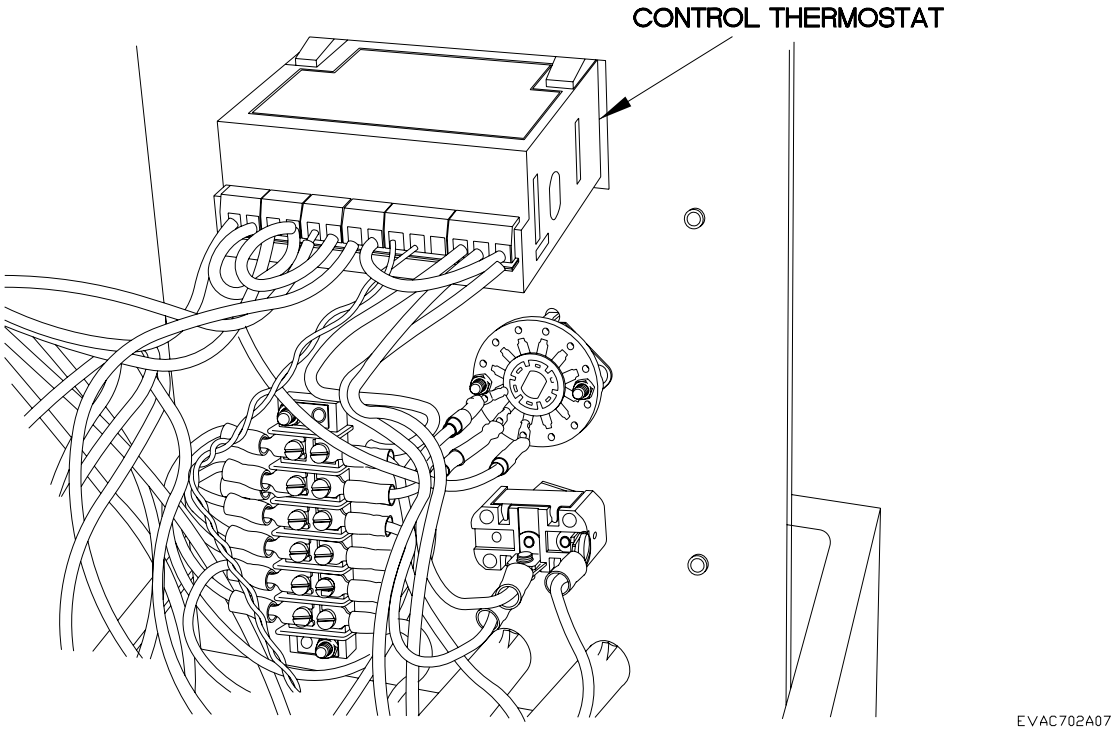
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
14. Is leak present in air conditioner unit?	No Replace Low Pressure Switch (Chapter 6.10). Yes Repair leak (Chapter 6.26).	1. Perform Air Conditioner Leak Test (Chapter 6.26).
15. Is 18-30 VAC present at control thermostat THT-259?	No Go to (Indication/Condition 16). Yes If voltage is present, and compressor does not activate after two minutes, replace thermostat (Chapter 6.21).	1. Open control box. 2. Remove four screws from control box face.
		3. Apply power (Chapter 6.25). 4. Connect positive (+) probe of multimeter to thermostat THT-259. 5. Connect negative (-) probe of multimeter to a known good ground.



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

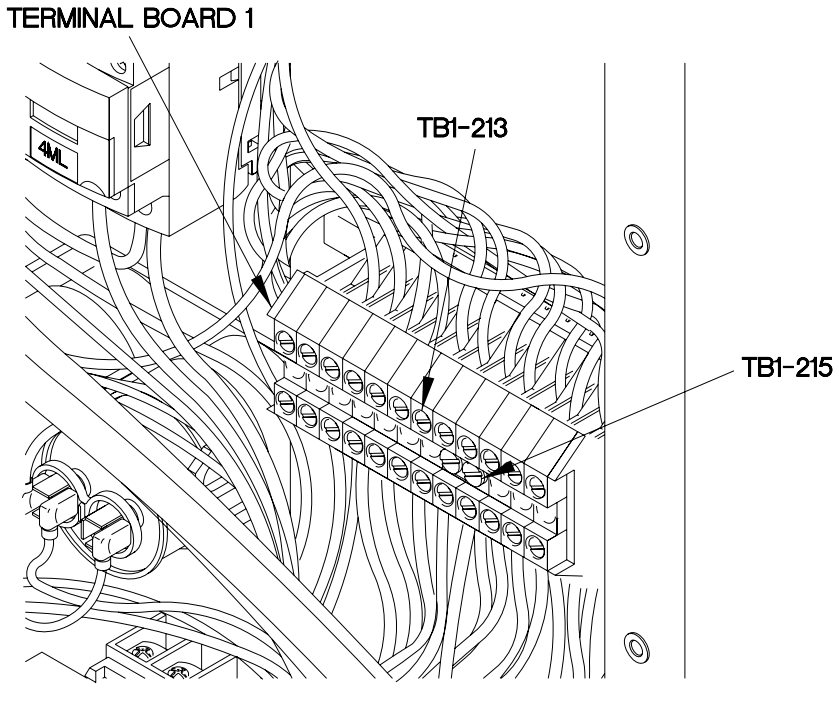
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
15. Is 18-30 VAC present at control thermostat THT-259?-Continued	No Go to (Indication/Condition 16). Yes If voltage is present, and compressor does not activate after two minutes, replace the thermostat (Chapter 6.21).	6. Note reading on digital multimeter.



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

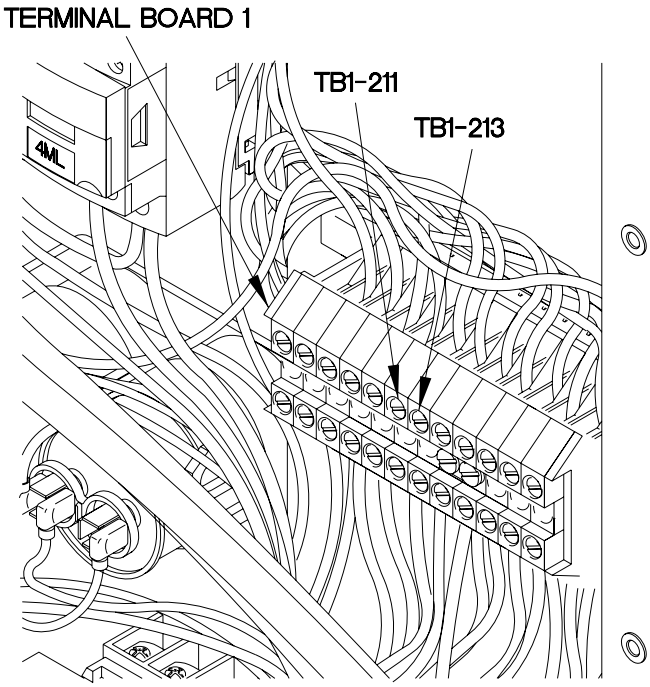
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
16. Is continuity present from wire 213 to wire 215?	No Repair wire (TM 9-2320-391-20) or replace Low Pressure Switch (Chapter 6.10). Yes Go to (Indication/Condition 17).	1. Connect positive (+) probe of digital multimeter to TB1-213. 2. Connect negative (-) probe of digital multimeter to TB1-215. 3. Note reading on digital multimeter.



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
17. Is continuity present from wire 211 to wire 213?	No Repair wire (TM 9-2320-391-20) or replace High Pressure Switch (Chapter 6.11). Yes Replace compressor (Chapter 6.9).	1. Connect positive (+) probe of digital multimeter to TB1-211. 2. Connect negative (-) probe of digital multimeter to TB1-213. 3. Note reading on digital multimeter.



EVAC701A19

COMPRESSOR IS EXCESSIVELY NOISY 7.3

THIS WORK PACKAGE COVERS:
ECU System Troubleshooting

INITIAL SETUP:

Maintenance Level
Field

Personnel Required
Two

Tools/Special Tools
Tool Kit, Genl Mech (NSN 5180-01-454-3787)
Multimeter (NSN 6625-01-139-2512)

Equipment Conditions
Outside AC panels removed (Chapter 6.24)

Materials/Parts
Ties, Cable, Plastic (NSN 5975-01-379-4997)

PROCEDURE

WARNING

Remove rings, bracelets, watches, necklaces, and any other jewelry before working around vehicle. Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Failure to comply may result in injury to personnel.

CAUTION

Use care when testing electrical connectors. Do not damage connector pins or sockets with multimeter probes. Failure to comply may result in damage to equipment.

NOTE

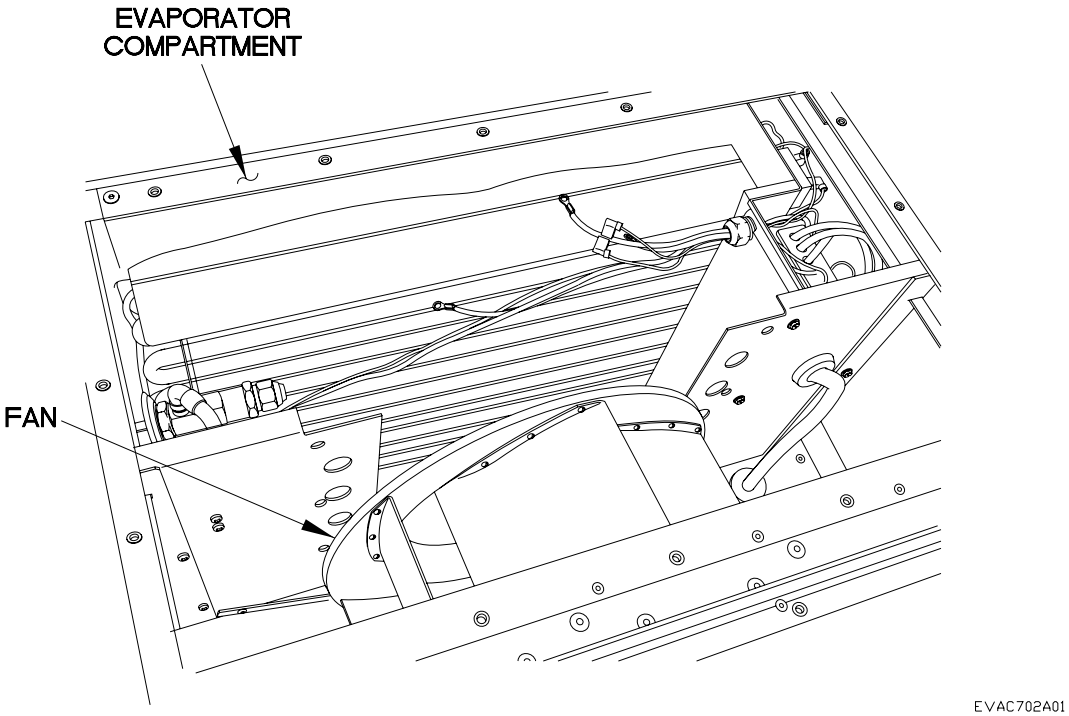
Refer to Refrigerant schematic as required.

Tag hoses and connection points prior to disconnecting.

Remove plastic cable ties as required.

ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
1. Is debris or blockage present in fan?	No Go to (Indication/Condition 2). Yes Remove debris from fan (TM 9-2320-392-10).	1. Check fan for obstruction or debris.
		
2. Is noise still present in compressor?	No Fault corrected. Yes Replace compressor (Chapter 6.9).	1. Replace compressor (Chapter 6.9). 2. Decontaminate system (Chapter 6.3.4).

NO CONDENSER AIR FLOW 7.4

THIS WORK PACKAGE COVERS:
ECU System Troubleshooting

INITIAL SETUP:

Maintenance Level
Field

Tools/Special Tools
Tool Kit, Genl Mech (NSN 5180-01-454-3787)
Multimeter (NSN 6625-01-139-2512)

Materials/Parts
Ties, Cable, Plastic (NSN 5975-01-379-4997)
Wire, Electrical 50 ft (NSN 6145-01-148-2263)

References
TM 9-2320-391-20 FMTV IETM (Electrical Wire and Cable Repair)

Personnel Required
Two

Equipment Conditions
Outside AC panels removed (Chapter 6.24)

PROCEDURE

WARNING

Remove rings, bracelets, watches, necklaces, and any other jewelry before working around vehicle. Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Failure to comply may result in injury to personnel.

CAUTION

Use care when testing electrical connectors. Do not damage connector pins or sockets with multimeter probes. Failure to comply may result in damage to equipment.

NOTE

Refer to Refrigerant schematic as required.

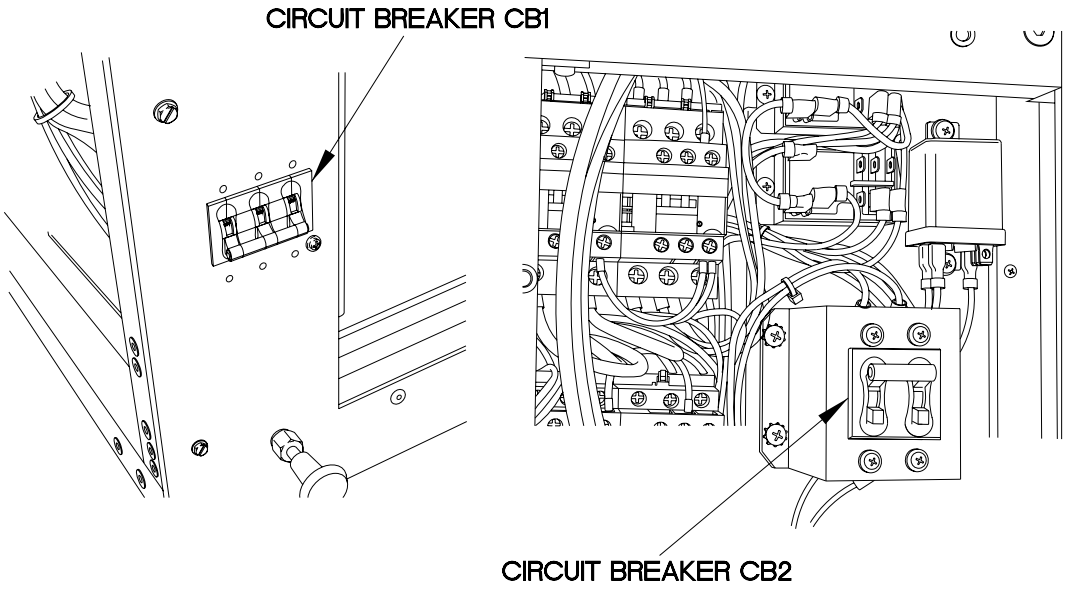
Tag hoses and connection points prior to disconnecting.

Remove plastic cable ties as required.

ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

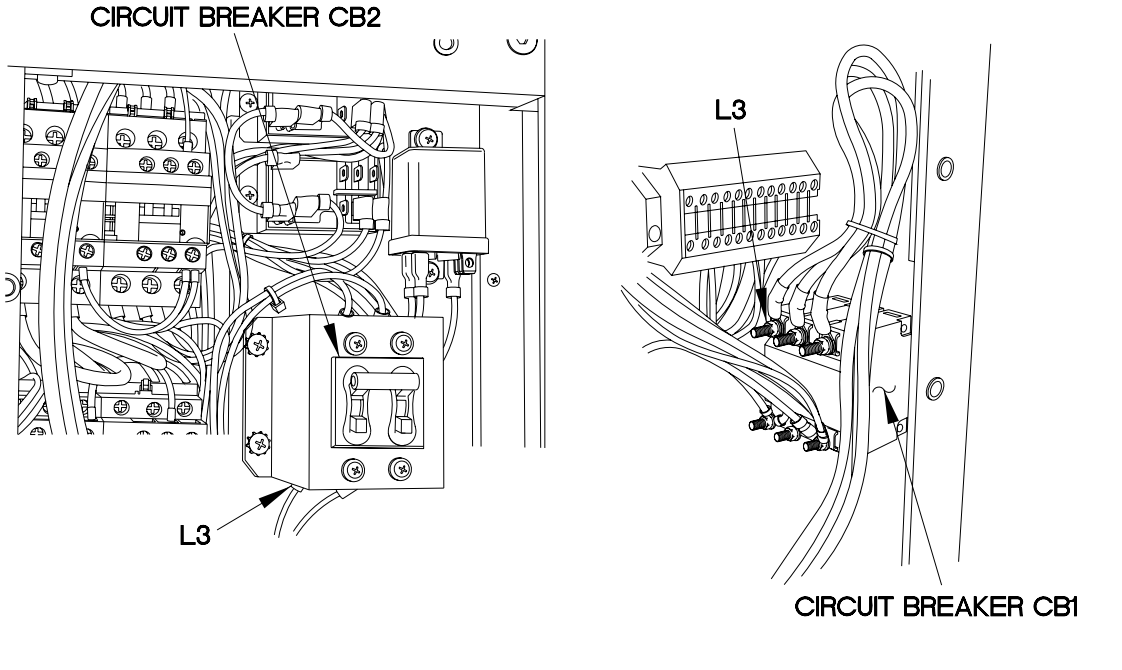
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
1. Is continuity present between circuit breaker CB1 and circuit breaker CB2?	No Repair wire L3 (TM 9-2320-391-20) or replace circuit breakers (Chapter 6.20).	1. Set multimeter to ohms.
	Yes Go to (Indication Condition 2).	2. Position circuit breaker CB1 to ON. 3. Position circuit breaker CB2 to ON.



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

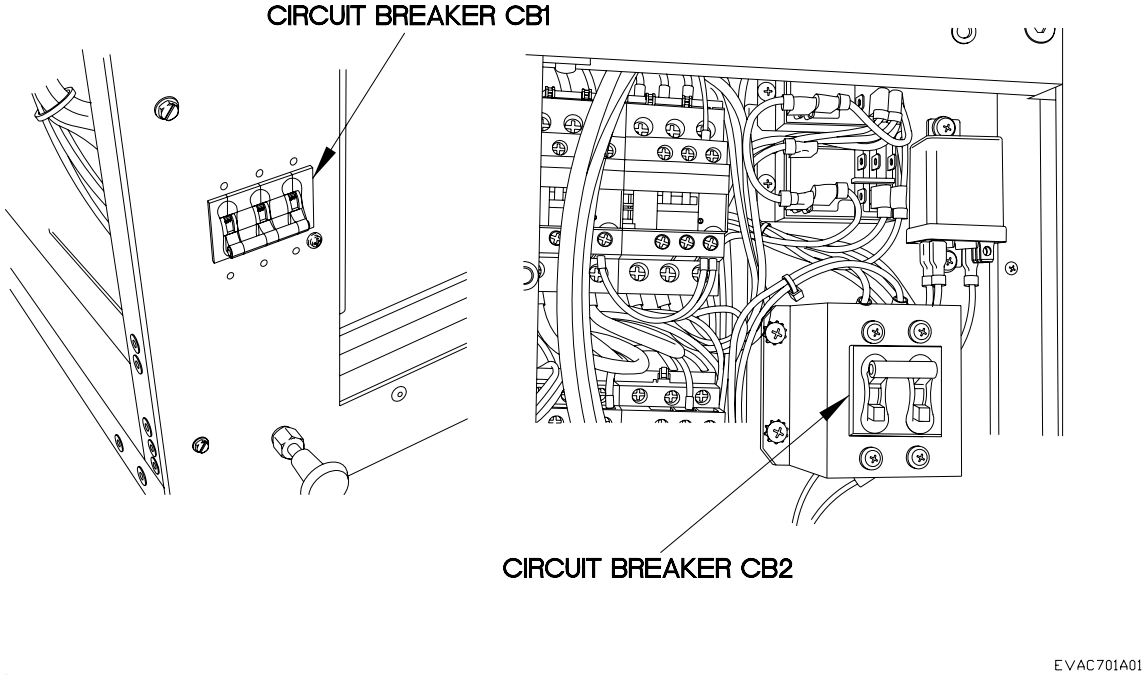
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
1. Is continuity present between circuit breaker CB1 and circuit breaker CB2?-Continued	No Repair wire L3 (TM 9-2320-391-20) or replace circuit breakers (Chapter 6.20).	4. Connect positive (+) probe of digital multimeter to circuit breaker CB1-L3.
	Yes Go to (Indication Condition 2).	5. Connect negative (-) probe of digital multimeter to circuit breaker CB2-L3.
		6. Note reading on digital multimeter.



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

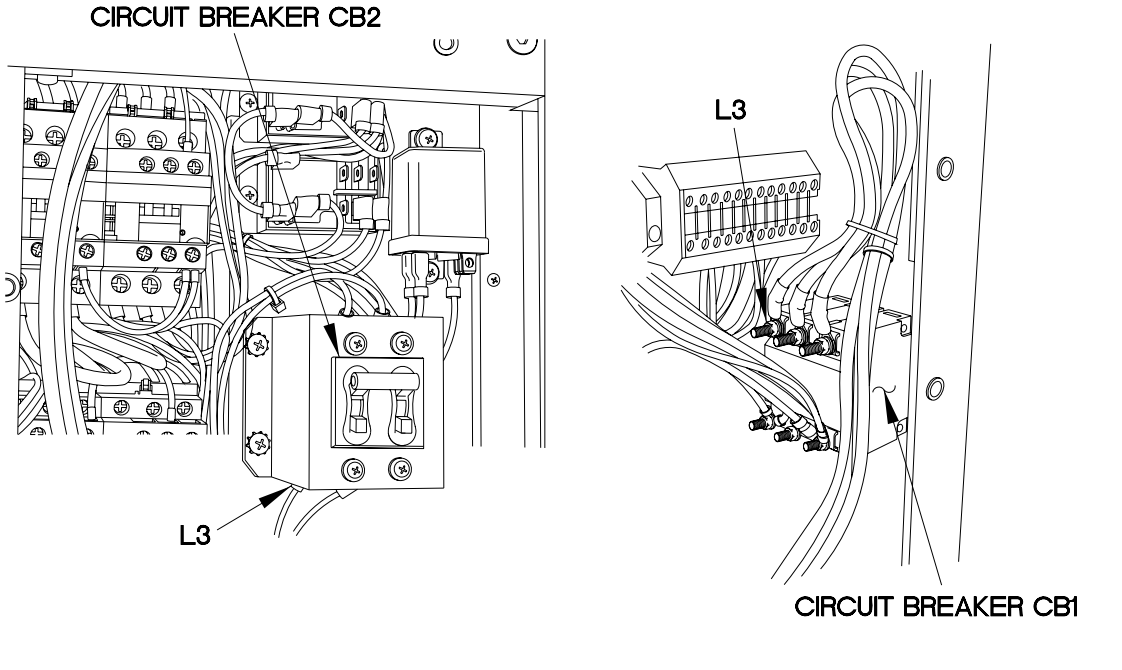
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
2. Is continuity present between CB1 and CB2 with circuit breakers in OFF position?	No Go to (Indication/Condition 3).	1. Position circuit breaker CB1 to OFF.
	Yes Repair wire L3 (TM 9-2320-391-20) or replace circuit breakers (Chapter 6.20).	2. Position circuit breaker CB2 to OFF.



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

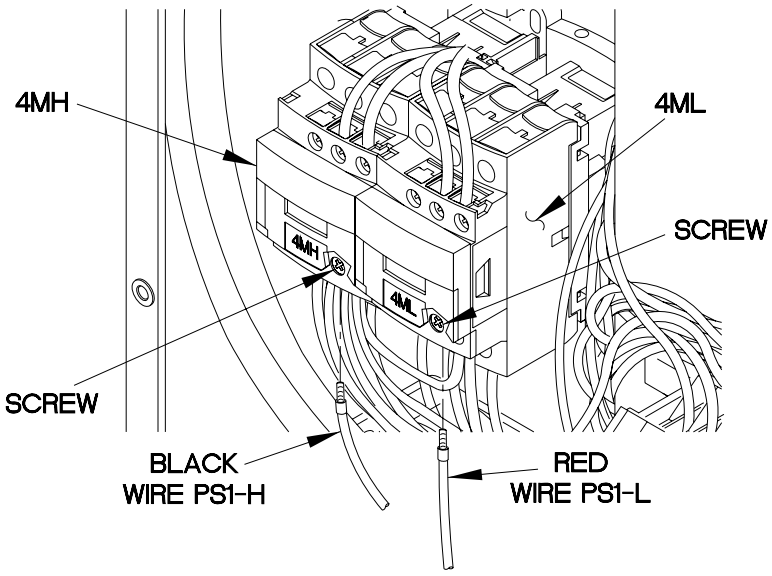
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
2. Is continuity present between CB1 and CB2 with circuit breakers in OFF position?-Continued	No Go to (Indication/Condition 3).	3. Connect positive (+) probe of digital multimeter to circuit breaker CB1-L3.
	Yes Repair wire L3 (TM 9-2320-391-20) or replace circuit breakers (Chapter 6.20).	4. Connect negative (-) probe of digital multimeter to circuit breaker CB2-L3. 5. Note reading on digital multimeter.



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

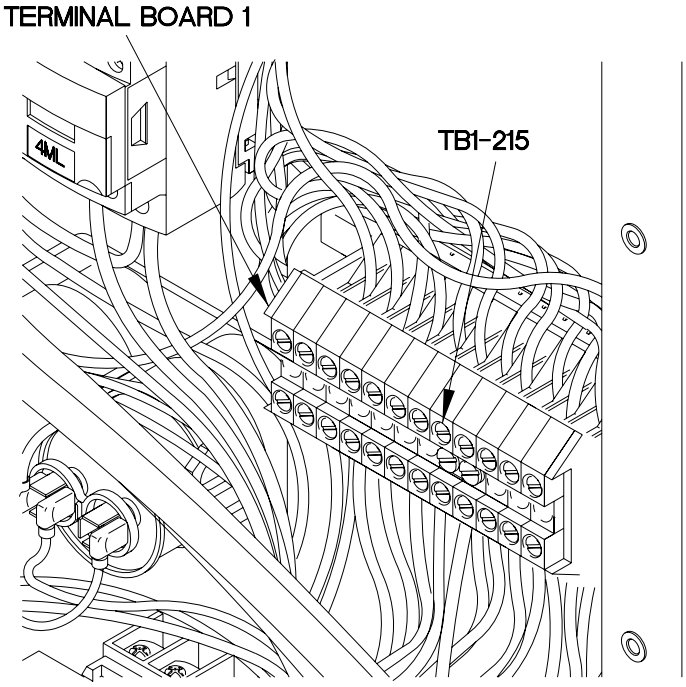
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
3. Is continuity present from wire 215 to wire 218?	No Repair wire or replace Fan Cycle Switch (Chapter 6.12). Yes Go to (Indication/Condition 4).	1. Loosen lower middle screw on contactor 4MH. 2. Remove black wire 218 from contactor 4MH. 3. Loosen lower middle screw on contactor 4ML. 4. Remove red wire 216 from contactor 4ML.



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

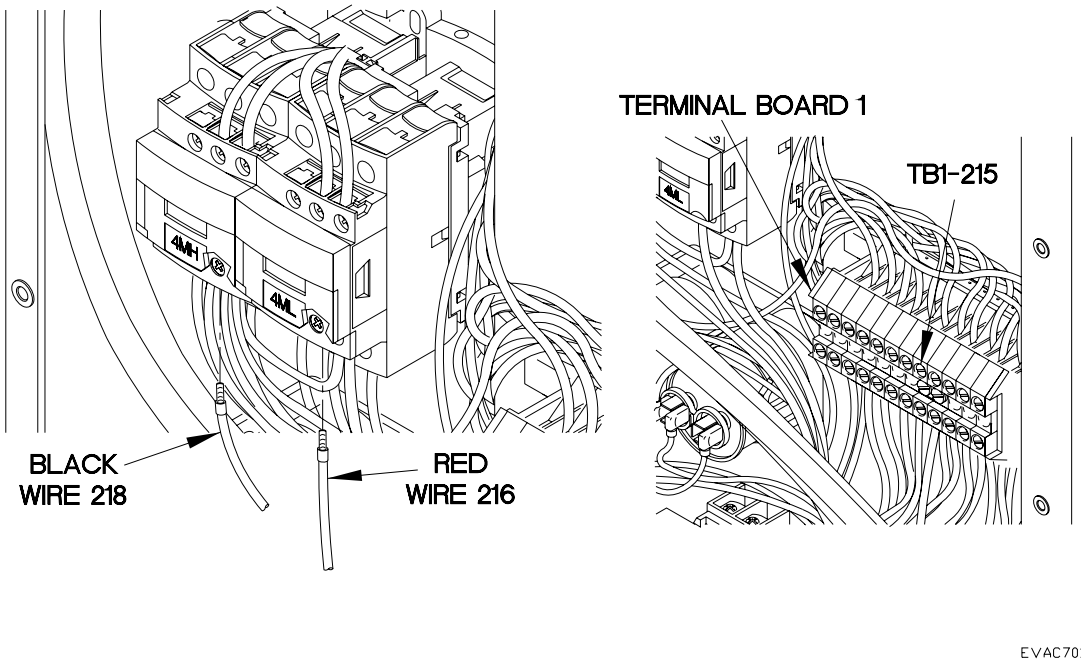
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
3. Is continuity present from wire 215 to wire 218?- Continued	No Repair wire or replace Fan Cycle Switch (Chapter 6.12). Yes Go to (Indication/Condition 4).	5. Loosen screw on wire 215 on terminal board. 6. Remove wire 215 from terminal board.



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

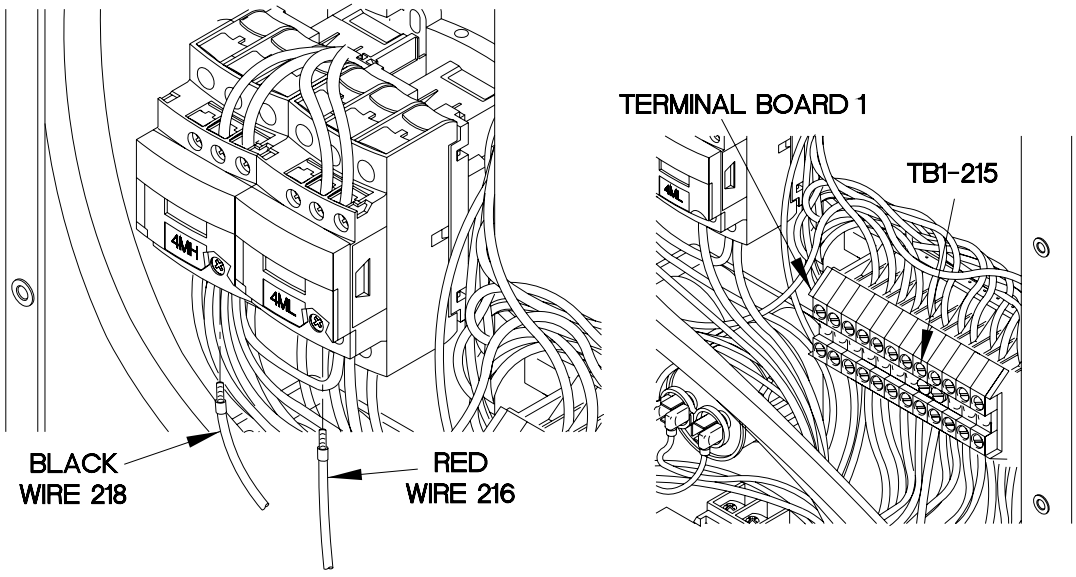
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
3. Is continuity present from wire 215 to wire 218?- Continued	No Repair wire or replace Fan Cycle Switch (Chapter 6.12). Yes Go to (Indication/Condition 4).	7. Connect positive (+) probe of digital multimeter to wire 215. 8. Connect negative (-) probe of digital multimeter to wire 218. 9. Note reading on digital multimeter.



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
4. Is continuity present from wire 216 to wire 215?	No Replace AC unit (Chapter 6.22). Yes Repair wire (TM 9-2320-391-20) or replace Fan Cycle Switch (Chapter 6.12).	1. Connect positive (+) probe of digital multimeter to wire 216. 2. Connect negative (-) probe of digital multimeter to wire 215. 3. Note reading on digital multimeter.



THIS WORK PACKAGE COVERS:
ECU System Troubleshooting

INITIAL SETUP:

Maintenance Level
Field

Personnel Required
Two

Tools/Special Tools
Tool Kit, Genl Mech (NSN 5180-01-454-3787)

Equipment Conditions
Outside AC panels removed (Chapter 6.24)

Materials/Parts
Ties, Cable, Plastic (NSN 5975-01-379-4997)

PROCEDURE

WARNING

Remove rings, bracelets, watches, necklaces, and any other jewelry before working around vehicle. Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Failure to comply may result in injury to personnel.

CAUTION

Use care when testing electrical connectors. Do not damage connector pins or sockets with multimeter probes. Failure to comply may result in damage to equipment.

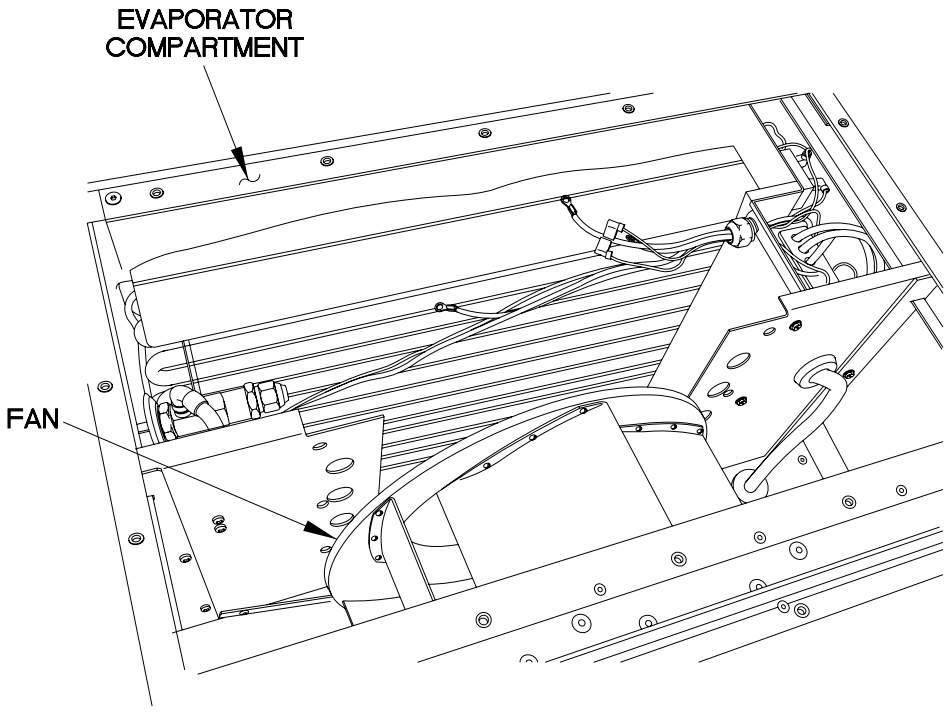
NOTE

Refer to Refrigerant schematic as required.

ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1. Is air flow restricted by debris or blockage?	No Go to (Indication/Condition 2). Yes Clean fan/compartment (Tool Kit, Refrigeration, 5180-00-596-1474).	1. Check fan for obstruction or debris.
2. Is air or other non-condensable gas in system?		1. Perform Air Conditioner System Refrigerant (R-134a) Maintenance (Chapter 11).



THIS WORK PACKAGE COVERS:
ECU System Troubleshooting

INITIAL SETUP:

Maintenance Level
Field

Tools/Special Tools
Tool Kit, Genl Mech (NSN 5180-01-454-3787)

Equipment Conditions
All AC panels removed (Chapter 6.24)

Materials/Parts
Ties, Cable, Plastic (NSN 5975-01-379-4997)

PROCEDURE

WARNING

Remove rings, bracelets, watches, necklaces, and any other jewelry before working around vehicle. Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Failure to comply may result in injury to personnel.

CAUTION

Use care when testing electrical connectors. Do not damage connector pins or sockets with multimeter probes. Failure to comply may result in damage to equipment.

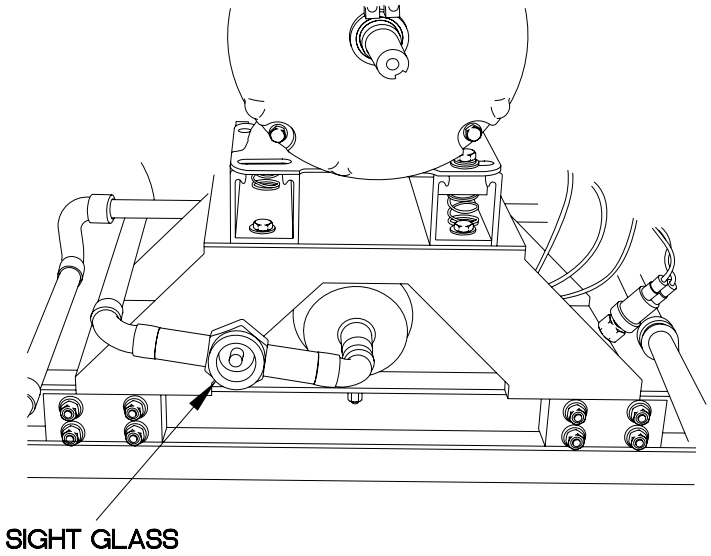
NOTE

Refer to Refrigerant schematic as required.

ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
1. Are leaks present in system?	No Recharge system (Chapter 11). Yes Repair leaks (Chapter 6.3.2).	1. Check for air bubbles in sight glass. 2. Perform Air Conditioner Leak Test (Chapter 6.26).



EVAC702A02

THIS WORK PACKAGE COVERS:
ECU System Troubleshooting

INITIAL SETUP:

Maintenance Level
Field

Personnel Required
Two

Tools/Special Tools
Tool Kit, Genl Mech (NSN 5180-01-454-3787)
Multimeter (NSN 6625-01-139-2512)

Equipment Conditions
Outside AC panels removed (Chapter 6.24)

Materials/Parts
Ties, Cable, Plastic (NSN 5975-01-379-4997)

PROCEDURE

WARNING

Remove rings, bracelets, watches, necklaces, and any other jewelry before working around vehicle. Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Failure to comply may result in injury to personnel.

CAUTION

Use care when testing electrical connectors. Do not damage connector pins or sockets with multimeter probes. Failure to comply may result in damage to equipment.

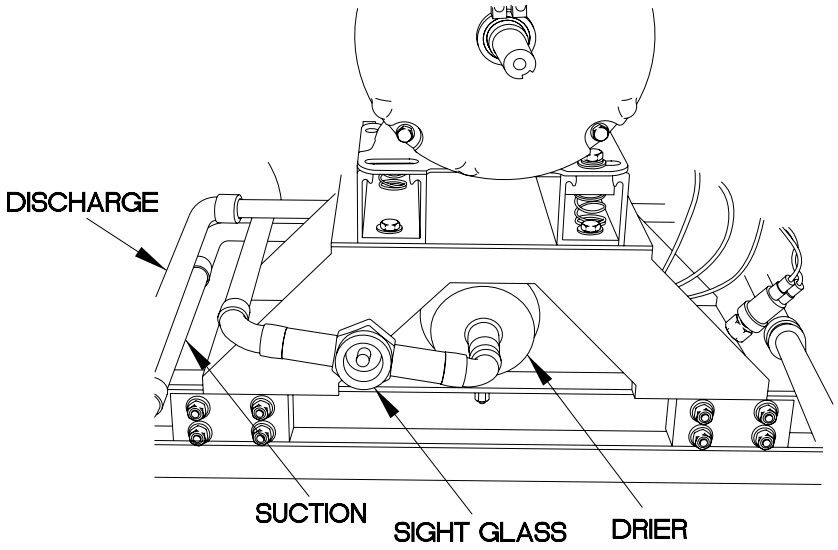
NOTE

Refer to Refrigerant schematic as required.

ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
1. Is expansion valve stuck in the open position?	No Go to (Indication/Condition 2).	1. Turn on AC (Chapter 5).
	Yes Replace expansion valve (Chapter 6.8).	2. Check to see if suction line is abnormally cold.
2. Is leak present in system?	No Replace filter/drier (Chapter 6.5).	1. Check for air bubbles in sight glass.
	Yes Repair leak (Chapter 6.26).	2. Perform Air Conditioner Leak Test (Chapter 6.26).



EVAC702A04

THIS WORK PACKAGE COVERS:
ECU System Troubleshooting

INITIAL SETUP:

Maintenance Level
Field

Personnel Required
Two

Tools/Special Tools
Tool Kit, Genl Mech (NSN 5180-01-454-3787)
Multimeter (NSN 6625-01-139-2512)

Equipment Conditions
Outside AC panels removed (Chapter 6.24)

Materials/Parts
Ties, Cable, Plastic (NSN 5975-01-379-4997)
Wire, Electrical 50 ft (NSN 6145-01-148-2263)

PROCEDURE

WARNING

Remove rings, bracelets, watches, necklaces, and any other jewelry before working around vehicle. Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Failure to comply may result in injury to personnel.

CAUTION

Use care when testing electrical connectors. Do not damage connector pins or sockets with multimeter probes. Failure to comply may result in damage to equipment.

NOTE

Refer to Refrigerant schematic as required.

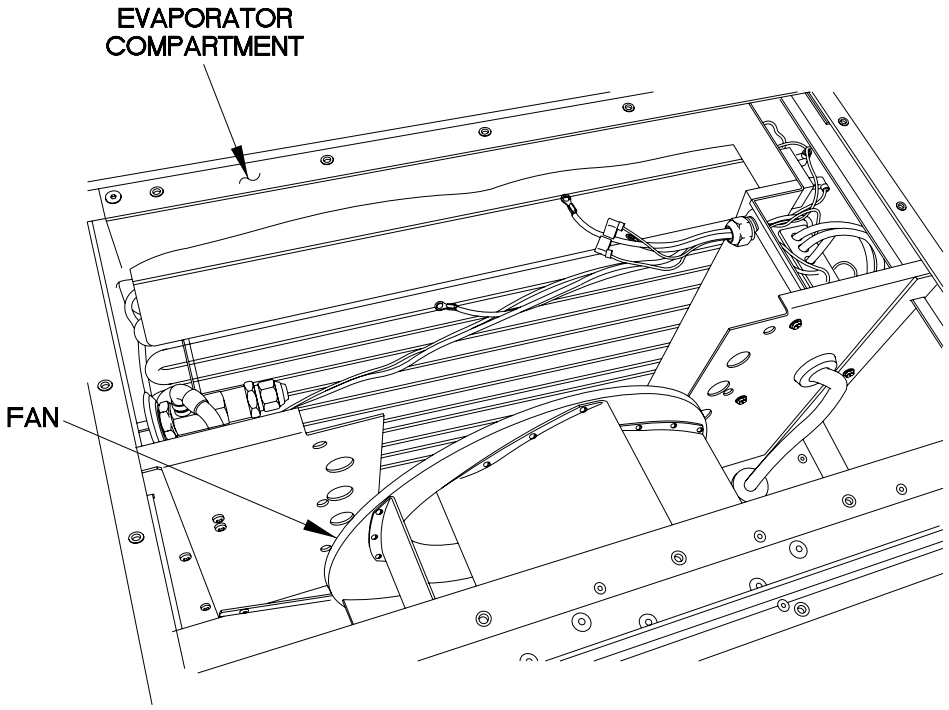
Remove plastic cable ties as required.

Tag hoses and connection points prior to disconnecting.

ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. Heater Does Not Operate

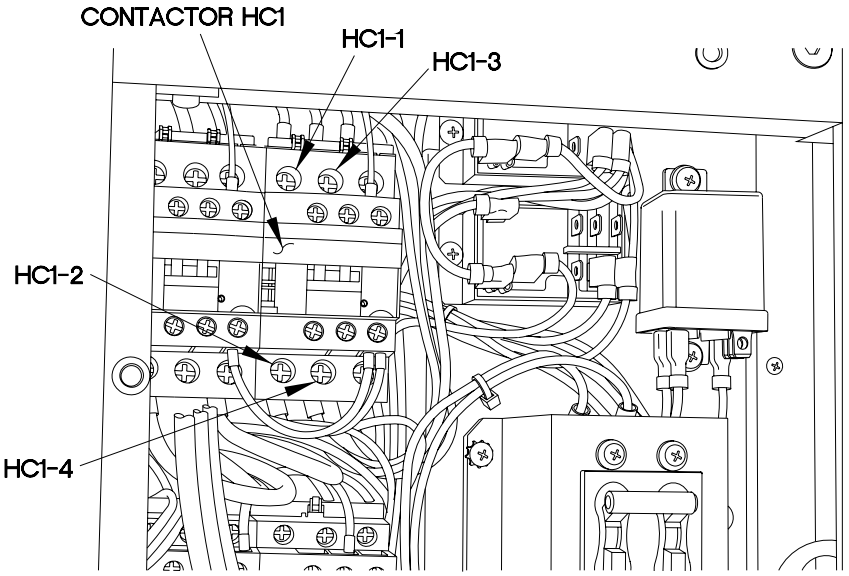
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
1. Is air flow restricted by debris or blockage?	No Go to (Indication/Condition 2). Yes Remove debris from fan (EM0195).	1. Check fan for obstruction or debris.



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. Heater Does Not Operate

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
2. Is continuity present across contactor HC1?	No Go to (Indication/Condition 3). Yes Replace heater contactor HC1 (Chapter 6.16).	1. Turn off power (Chapter 6.25). 2. Connect positive (+) probe of digital multimeter to contactor HC1-1. 3. Connect negative (-) probe of digital multimeter to contactor HC1-2. 4. Note reading on digital multimeter. 5. Connect positive (+) probe of digital multimeter to contactor HC1-3. 6. Connect negative (-) probe of digital multimeter to contactor HC1-4. 7. Note reading on digital multimeter.

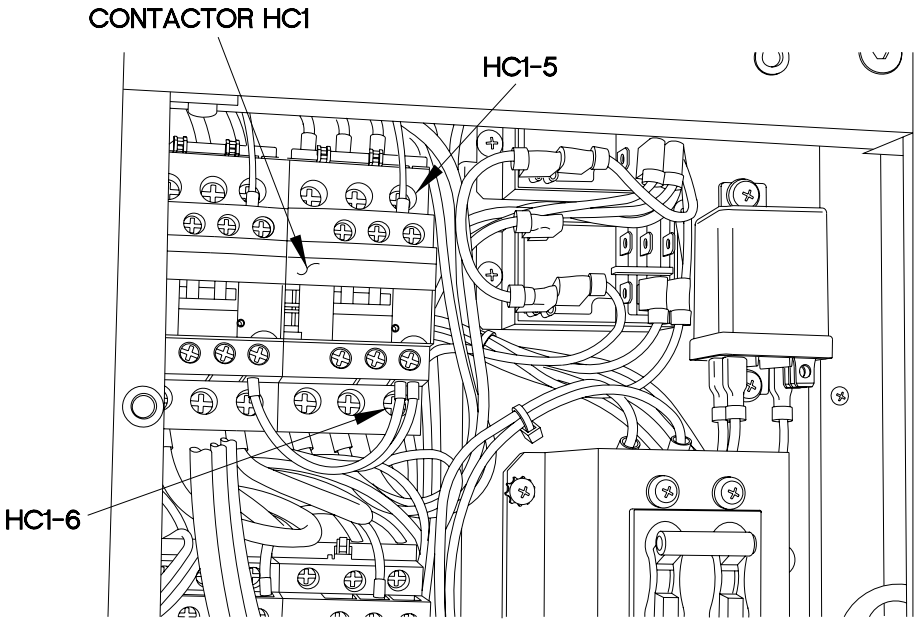


EVAC701A72

ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. Heater Does Not Operate

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
2. Is continuity present across contactor HC1?-Continued	No Go to (Indication/Condition 3).	8. Connect positive (+) probe of digital multimeter to contactor HC1-5.
	Yes Replace heater contactor HC1 (Chapter 6.16).	9. Connect positive (+) probe of digital multimeter to contactor HC1-6.
		10. Note reading on digital multimeter.

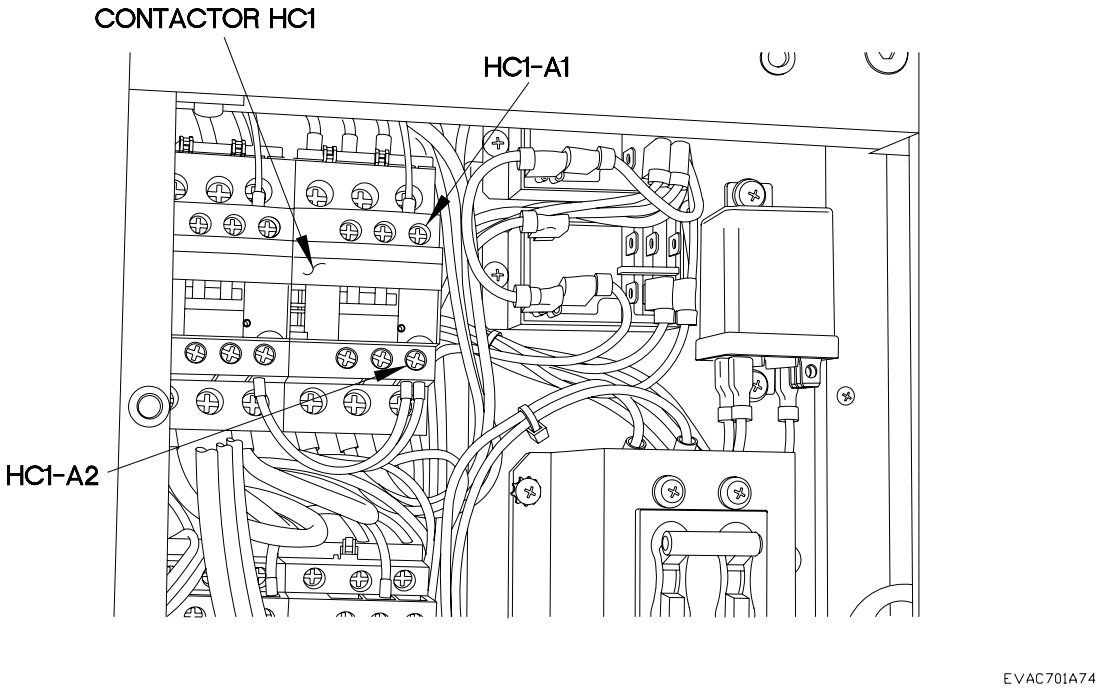


EVAC701A73

ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. Heater Does Not Operate

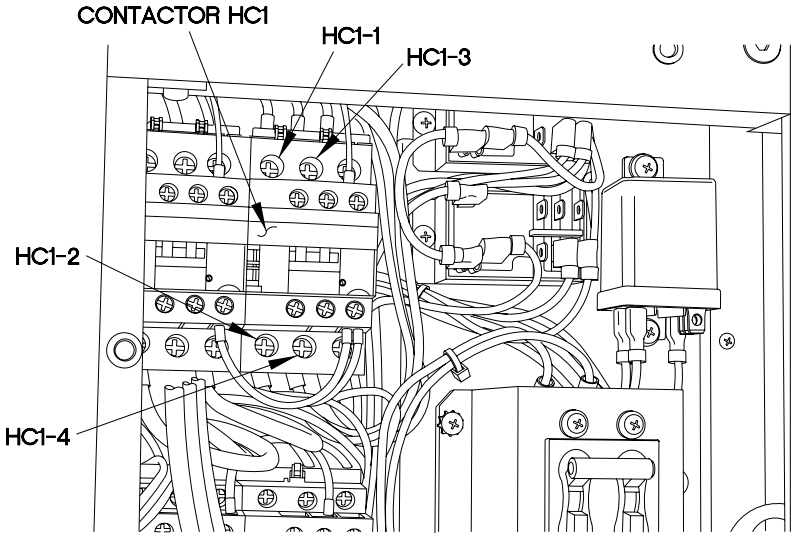
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
3. Is continuity present across heater contactor HC1-A1 to HC1-A2?	No Replace heater contactor HC1 (Chapter 6.16). Yes Go to (Indication/Condition 4).	1. Connect positive (+) probe of digital multimeter to contactor HC1-A1. 2. Connect negative (-) probe of digital multimeter to contactor HC1-A2.
		3. Note reading on digital multimeter.



ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. Heater Does Not Operate

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
4. Is continuity present across heater contactor HC1 with power applied?	No Replace heater contactor HC1 (Chapter 6.16).	1. Apply power (Chapter 6.25).
	Yes Go to (Indication/Condition 5).	2. Connect positive (+) probe of digital multimeter to heater contactor HC1-1. 3. Connect negative (-) probe of digital multimeter to contactor HC1-2. 4. Note reading on digital multimeter. 5. Connect positive (+) probe of digital multimeter to contactor HC1-3. 6. Connect negative (-) probe of digital multimeter to contactor HC1-4.
		7. Note reading on digital multimeter.

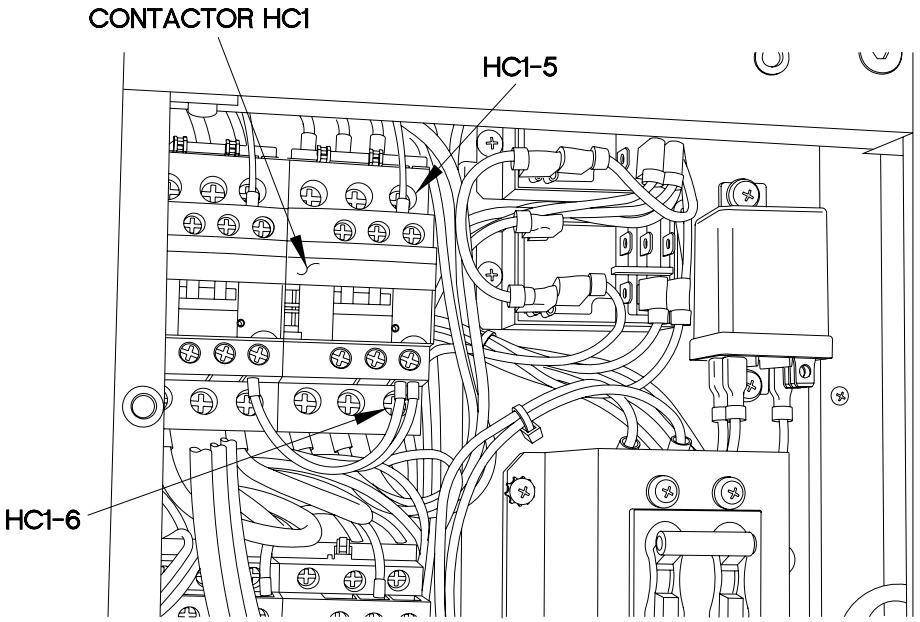


EVAC701A72

ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. Heater Does Not Operate

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
4. Is continuity present across heater contactor HC1 with power applied?	No Replace heater contactor HC1 (Chapter 6.16). Yes Go to (Indication/Condition 5).	8. Connect positive (+) probe of digital multimeter to contactor HC1-5. 9. Connect negative (-) probe of digital multimeter to contactor HC1-6. 10. Note reading on digital multimeter.

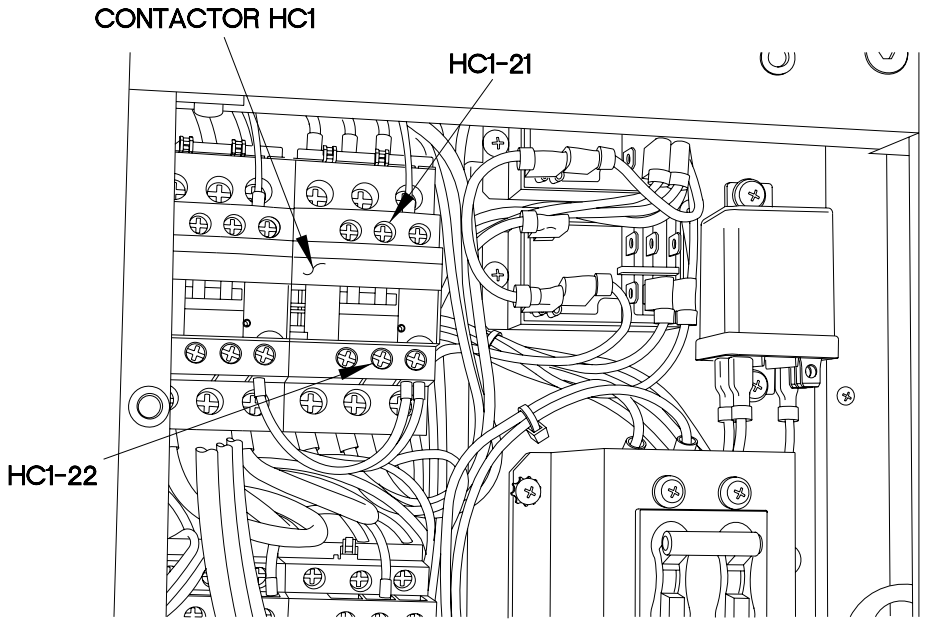


EVAC701A73

ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. Heater Does Not Operate

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
5. Is continuity present across heater contactor HC1-21 to HC1-22?	No Replace heater contactor HC1 (Chapter 6.16). Yes Go to (Indication/Condition 6).	1. Connect positive (+) probe of digital multimeter to contactor HC1-21. 2. Connect negative (-) probe of digital multimeter to contactor HC1-22.
		3. Note reading on digital multimeter

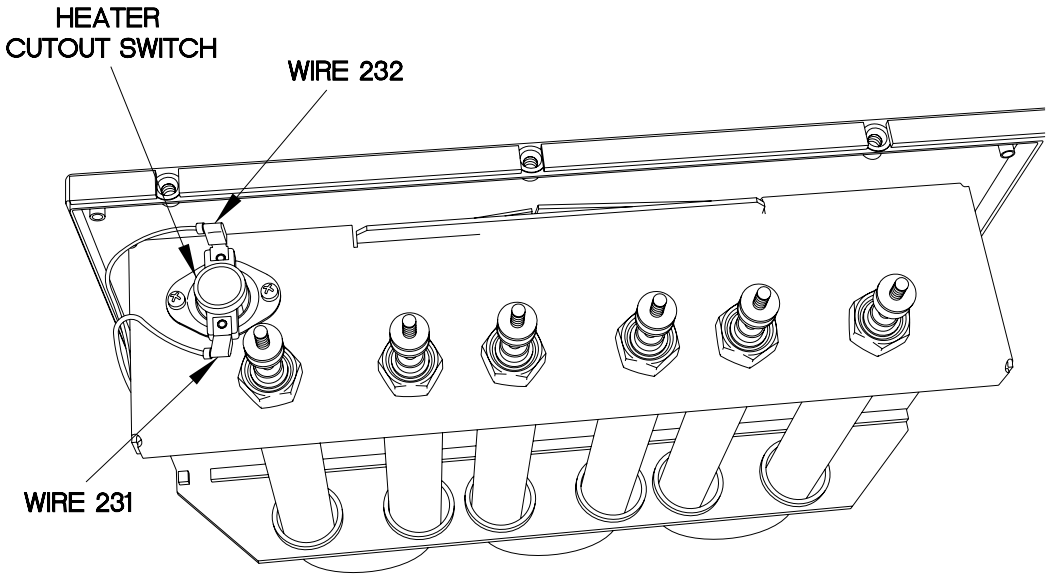


EVAC701A75

ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. Heater Does Not Operate

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDUREAL STEPS
6. Is continuity present across switch with ambient temperatures bellow 120°F?	No Replace heater cutout switch (HT1) (Chapter 6.15).	1. Connect positive (+) probe of digital multimeter to terminal connector wire 231.
	Yes Replace heater (Chapter 6.15).	2. Connect negative (-) probe of digital multimeter to terminal connector wire 232. 3. Note reading on digital multimeter. 4. If continuity is not present, replace heater cutout switch (HT1) (Chapter 6.15).



SPEED SELECTOR SWITCH DOES NOT OPERATE 7.9

THIS WORK PACKAGE COVERS:
Electrical System Troubleshooting

INITIAL SETUP:

Maintenance Level
Field

Tools/Special Tools
Tool Kit, Genl Mech (NSN 5180-01-454-3787)
Multimeter (NSN 6625-01-139-2512)

Materials/Parts
Ties, Cable, Plastic (NSN 5975-01-379-4997)
Wire, Electrical 50 ft (NSN 6145-01-148-2263)

References
TM 9-2320-391-20 FMTV IETM (Electrical Wire and Cable Repair)

Personnel Required
Two

Equipment Conditions
Outside AC panels removed (Chapter 6.24)

PROCEDURE

WARNING

Remove rings, bracelets, watches, necklaces, and any other jewelry before working around vehicle. Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Failure to comply may result in injury to personnel.

CAUTION

Use care when testing electrical connectors. Do not damage connector pins or sockets with multimeter probes. Failure to comply may result in damage to equipment.

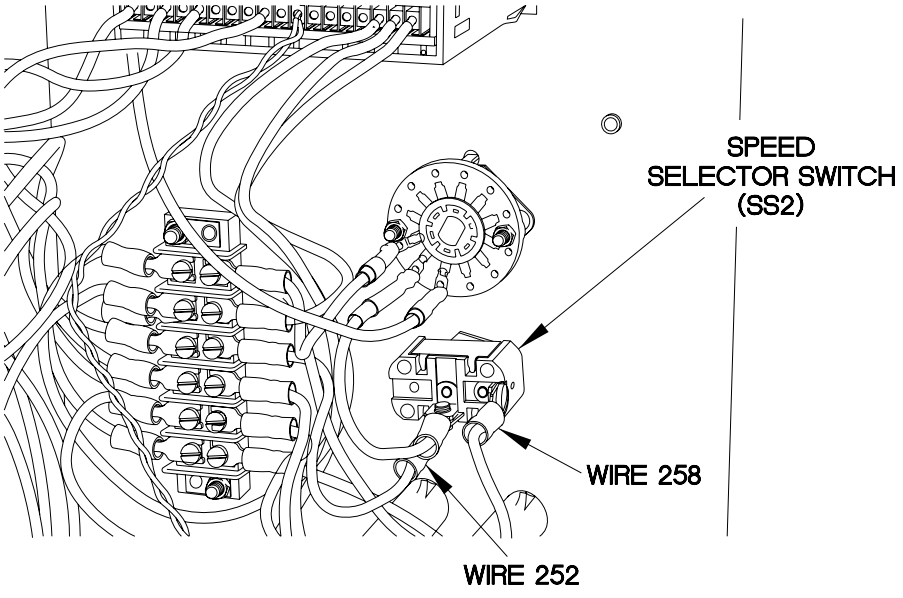
NOTE

Refer to Electrical Schematic as required.

ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

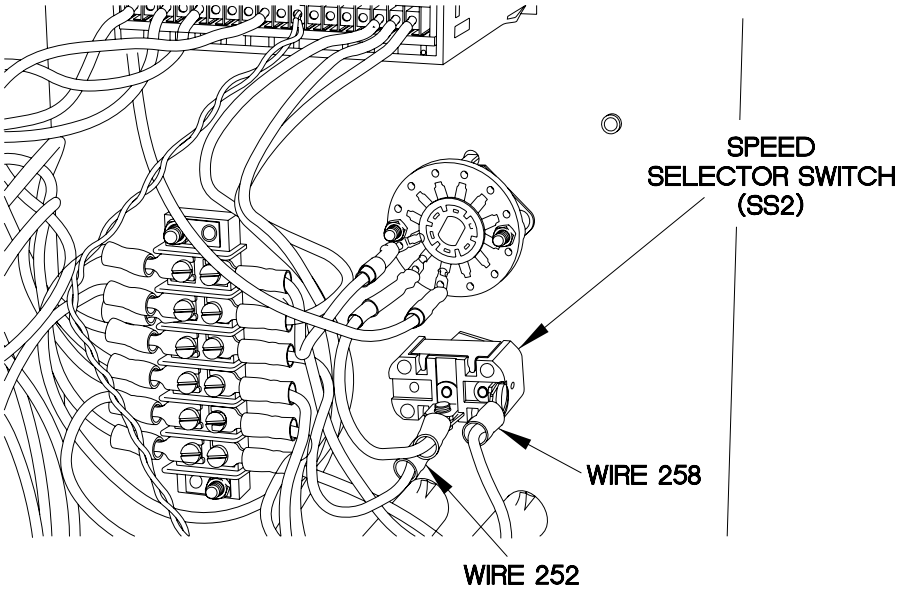
INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
1. Is continuity present from wire 252 to wire 258 while in LOW SPEED position?	No Go to (Indication/Condition 2).	1. Position speed selector switch in LOW SPEED position.
	Yes Repair wire (TM 9-2320-391-20) or replace evaporator speed selector switch (SS2) (Chapter 6.21).	2. Connect positive (+) probe of digital multimeter to wire 252.
		3. Connect negative (-) probe of digital multimeter to wire 258.
		4. Note reading on digital multimeter.



ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
2. Is continuity present from wire 252 to wire 258?	No Repair wire (TM 9-2320-391-20) or replace evaporator speed selector switch (SS2) (Chapter 6.21).	1. Position evaporator speed selector switch in HIGH SPEED position.
	Yes Replace remote control box (Chapter 6.21).	2. Connect positive (+) probe of digital multimeter to wire 252.
		3. Connect negative (-) probe of digital multimeter to wire 258.
		4. Note reading on digital multimeter.



EVAC701A26

THIS WORK PACKAGE COVERS:
Electrical System Troubleshooting

INITIAL SETUP:

Maintenance Level
Field

Tools/Special Tools
Tool Kit, Genl Mech (NSN 5180-01-454-3787)
Multimeter (NSN 6625-01-139-2512)

Materials/Parts
Ties, Cable, Plastic (NSN 5975-01-379-4997)
Wire, Electrical 50 ft (NSN 6145-01-148-2263)

References
TM 9-2320-391-20 FMTV IETM (Electrical Wire and Cable Repair)

Personnel Required
Two

Equipment Conditions
Outside AC panels removed (Chapter 6.24)

PROCEDURE

WARNING

Remove rings, bracelets, watches, necklaces, and any other jewelry before working around vehicle. Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Failure to comply may result in injury to personnel.

CAUTION

Use care when testing electrical connectors. Do not damage connector pins or sockets with multimeter probes. Failure to comply may result in damage to equipment.

NOTE

Refer to Electrical Schematic as required.

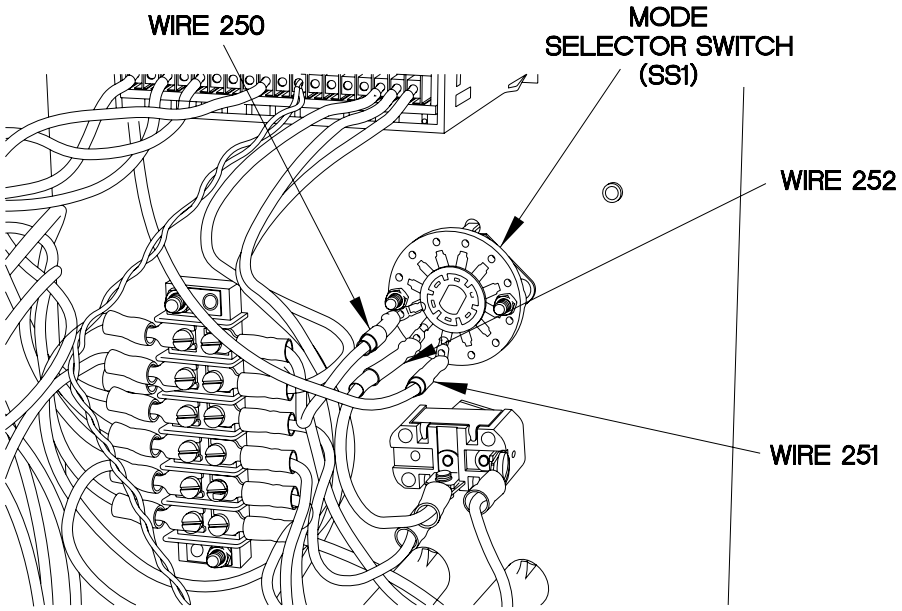
Remove plastic cable ties as required.

Tag hoses and connection points prior to disconnecting.

ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
1. Is continuity present across wire 250, 251, and 252?	No Go to (Indication/Condition 2). Yes Repair wire (TM 9-2320-391-20) or replace mode selection switch (SS1) (Chapter 6.21).	1. Position mode selection switch (SS1) to OFF position. 2. Connect positive (+) probe of digital multimeter to wire 250. 3. Connect negative (-) probe of digital multimeter to wire 251. 4. Note reading on digital multimeter.
		5. Connect negative (-) probe of digital multimeter to wire 252. 6. Note reading on digital multimeter.

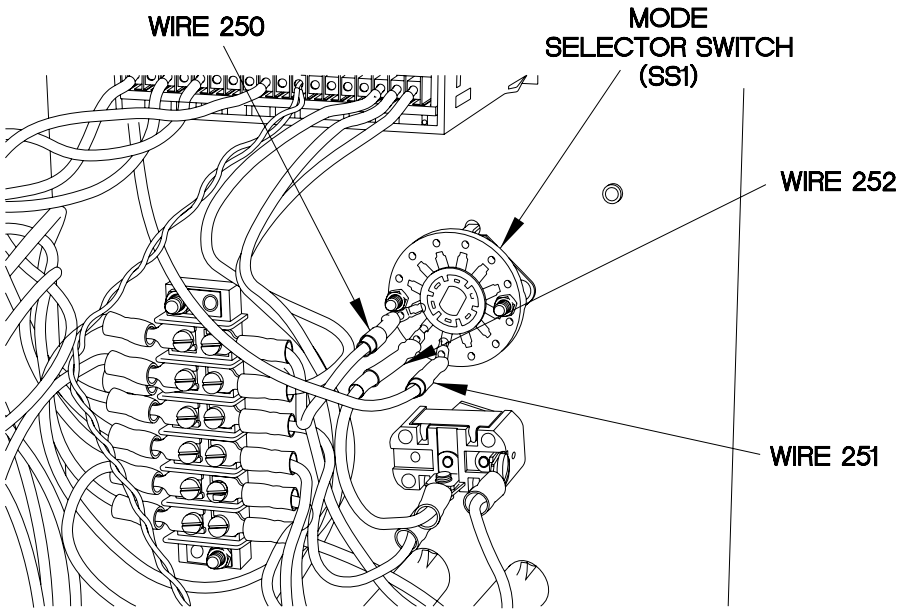


EVAC701A25

ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
1. Is continuity present across wire 250, 251, and 252?-Continued	No Go to (Indication/Condition 2).	7. Connect positive (+) probe of digital multimeter to wire 251.
	Yes Repair wire (TM 9-2320-391-20) or replace mode selection switch (SS1) (Chapter 6.21).	8. Note reading on digital multimeter.

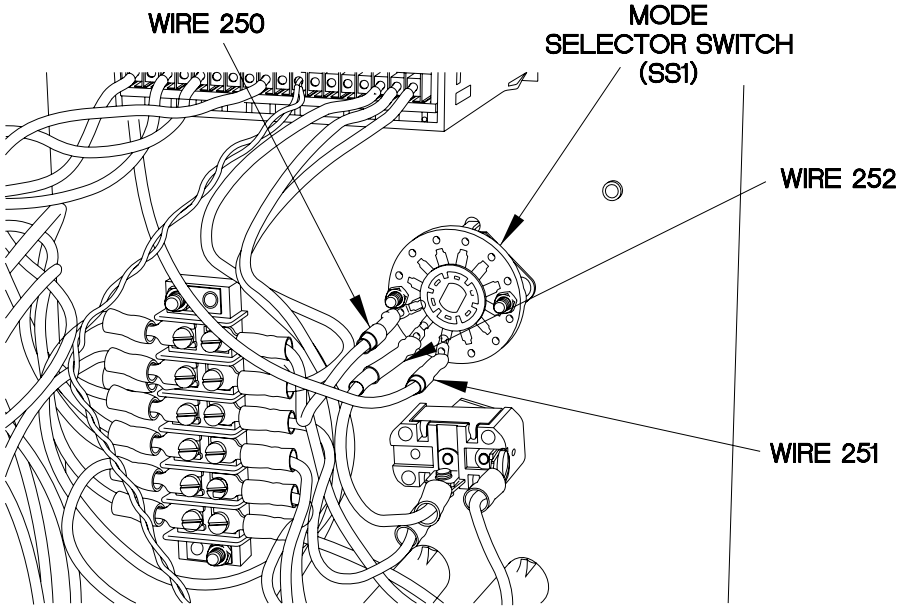


EVAC701A25

ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
2. Is continuity present between wire 250 and wire 252?	No Repair wire (TM 9-2320-391-20) or replace mode selection switch (SS1) (Chapter 6.21).	1. Position mode selection switch (SS1) to FAN position.
	Yes Go to (Indication/Condition 3).	2. Connect positive (+) probe of digital multimeter to wire 250. 3. Connect negative (-) probe of digital multimeter to wire 252. 4. Note reading on digital multimeter.

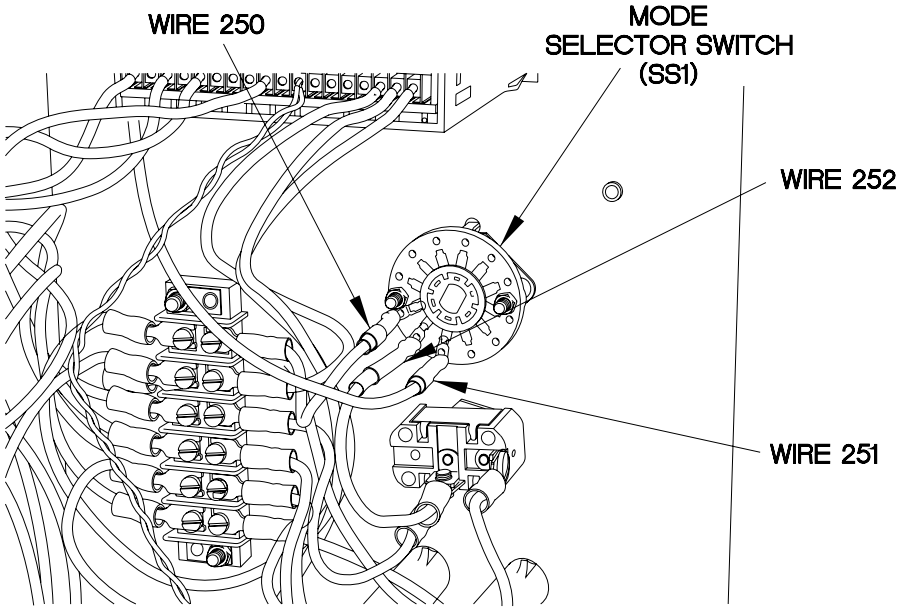


EVAC701A25

ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
3. Is continuity present between wires 250 and 252 to wire 251?	No Go to (Indication/Condition 4). Yes Repair wire (TM 9-2320-391-20) or replace mode selection switch (SS1) (Chapter 6.21).	1. Connect positive (+) probe of digital multimeter to wire 251. 2. Connect negative (-) probe of digital multimeter to wire 250. 3. Note reading on digital multimeter.

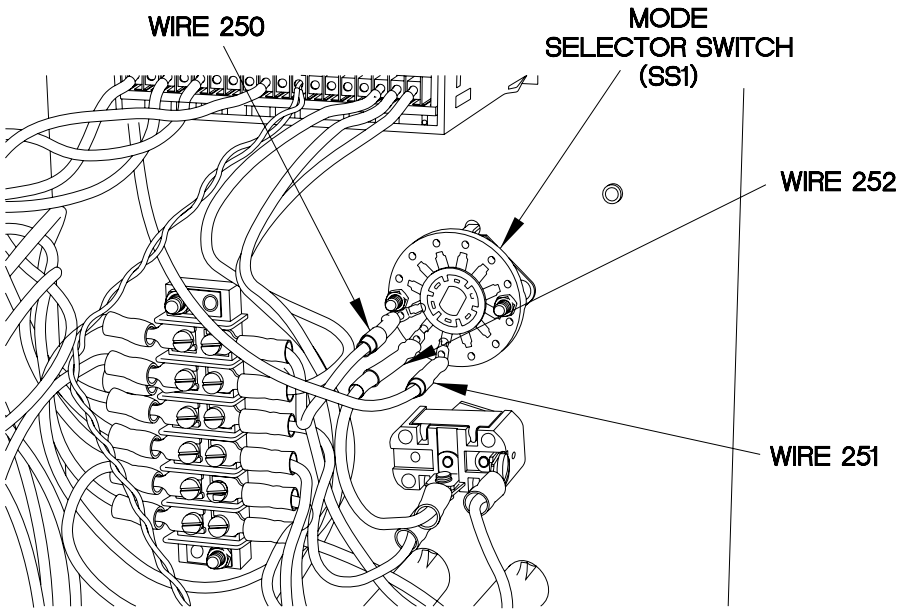


EVAC701A25

ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
3. Is continuity present between wires 250 and 252 to wire 251?-Continued	No Go to (Indication/Condition 4).	4. Connect negative (-) probe of digital multimeter to wire 252.
	Yes Repair wire (TM 9-2320-391-20) or replace mode selection switch (SS1) (Chapter 6.21).	5. Note reading on digital multimeter.

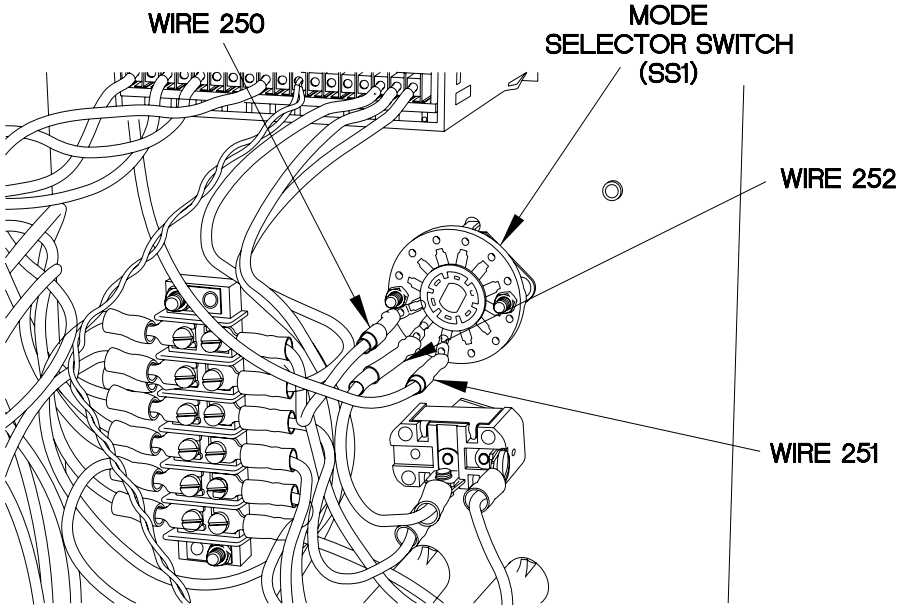


EVAC701A25

ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
4. Is continuity present between wire 250 and wire 252?	No Repair wire (TM 9-2320-391-20) or replace mode selection switch (SS1) (Chapter 6.21). Yes Go to (Indication/Condition 5).	1. Position mode selection switch (SS1) to AUTO position. 2. Connect positive (+) probe of digital multimeter to wire 250. 3. Connect negative (-) probe of digital multimeter to wire 252. 4. Note reading on digital multimeter

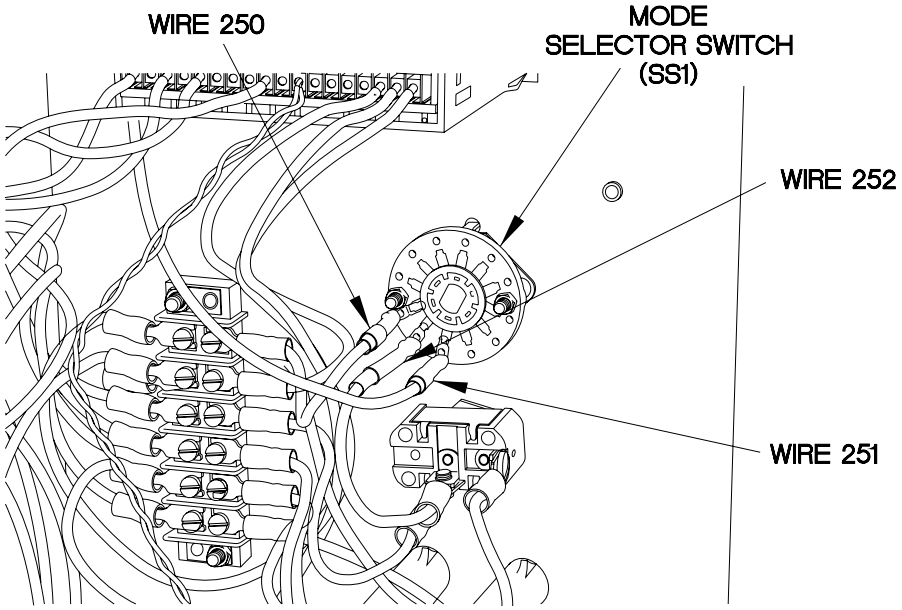


EVAC701A25

ELECTRICAL SYSTEM TROUBLESHOOTING - Continued

Table 1. Electrical System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
5. Is continuity present between wire 250 and wire 251?	No Repair wire (TM 9-2320-391-20) or replace mode selection switch (SS1) (Chapter 6.21). Yes Replace remote control box (Chapter 6.21).	1. Connect positive (+) probe of digital multimeter to wire 250. 2. Connect negative (-) probe of digital multimeter to wire 251. 3. Note reading on digital multimeter.



ENVIRONMENTAL CONTROL UNIT (ECU) FAILS TO START IN FAN MODE 7.11

THIS WORK PACKAGE COVERS:
ECU System Troubleshooting

INITIAL SETUP:

Maintenance Level
Field

Personnel Required
Two

Tools/Special Tools
Tool Kit, Genl Mech (NSN 5180-01-454-3787)
Multimeter (NSN 6625-01-139-2512)

Equipment Conditions
Outside AC panels removed (Chapter 6.24)

Materials/Parts
Ties, Cable, Plastic (NSN 5975-01-379-4997)

PROCEDURE

WARNING

Remove rings, bracelets, watches, necklaces, and any other jewelry before working around vehicle. Jewelry can catch on equipment and cause injury or short across electrical circuit and cause severe burns or electrical shock. Failure to comply may result in injury to personnel.

CAUTION

Use care when testing electrical connectors. Do not damage connector pins or sockets with multimeter probes. Failure to comply may result in damage to equipment.

NOTE

Refer to Refrigerant schematic as required.

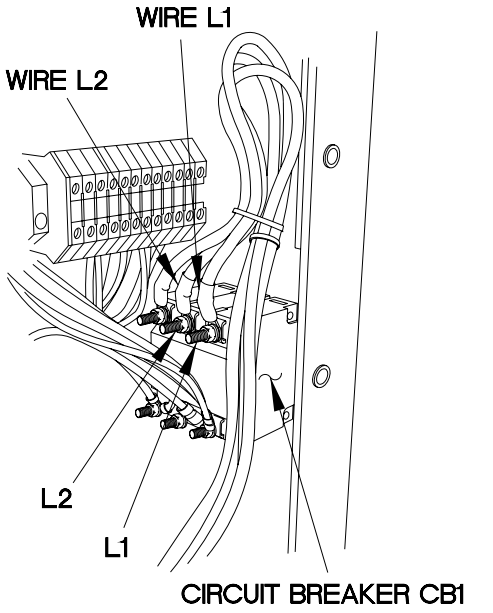
Remove plastic cable ties as required.

Tag hoses and connection points prior to disconnecting.

ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
1. Has Environmental Control Unit (ECU) Does Not Start been performed?	No Perform Environmental Control Unit (ECU) Does Not Start (Chapter 7.1).	
	Yes Go to (Indication/Condition 2).	
2. Is phase reversal present in power connection?	No Continue electrical troubleshooting in TM 9-2320-392-20.	1. Shut off power (Chapter 6.25).
	Yes Correct wiring.	2. Remove control panel covering. 3. Disconnect wire L1 at CB1-L1. 4. Disconnect wire L2 at CB1-L2.

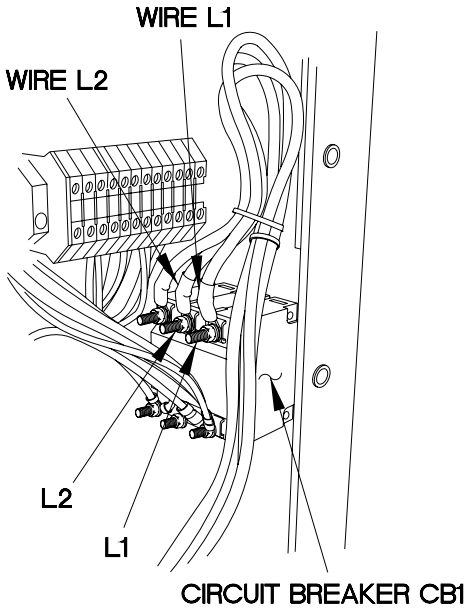


EVAC702A03

ECU SYSTEM TROUBLESHOOTING - Continued

Table 1. ECU System Troubleshooting Procedures

INDICATION/CONDITION	DECISION (NO/YES)	PROCEDURAL STEPS
2. Is phase reversal present in power connection?-Continued	No Continue electrical troubleshooting in TM 9-2320-392-20.	5. Connect wire L1 at CB1-L2.
	Yes Correct wiring.	6. Connect wire L2 at CB1-L1. 7. Apply power (Chapter 6.25). 8. Connect positive (+) probe of digital multimeter to wire L1 at CB1-L2. 9. Connect negative (-) probe of digital multimeter to a known good ground. 10. Note reading on digital multimeter.



EVAC702A03

8 Specifications

Specifications:

Dimensions	L 46” x W 34” x H 26” (W & H over mount flange) (L 1168mm x W 864mm x H 660mm)
Weight	420 lbs (191kg) Less: Electrical Power Cord, Remote cord, and Remote Control
Storage Temperature	-60°F (-51°C) to +160°F (+71°C)
Operational Ambient Temperature Range	Heating: -25°F (-31°C) to +90°F (+33°C) Cooling: +50°F (+10°C) to +125°F (+51.6°C)
Incline Operation:	The ECU shall be capable of operation @ 10° incline in any horizontal direction.
Cooling Capacity:	48,000 BTUH
Heating Capacity:	20,000 BTU/Hr, @ 208 VAC
POWER	
Main Voltage	208-230VAC/3Ph/50-60Hz
Power Connection	97-3102A22-22P (4 Pin)
Main Circuit Breaker	CB1- 40 Amp, 3 pole, Hydraulic Type
(Optional) Power Cable	#12 AWG, 4 Conductor Power Cable with Single MS-3456W22-22 Connector, opposite end is not terminated.
Control Voltage	24VAC/1Ph/50-60Hz
Control Connection	97-3102A18-1S for Remote Pilot Control.
Control Circuit Breaker	CB2- 1 Amp, 2 Pole, Hydraulic Type
CONDENSER	
Compressor	Hermetic Scroll, (208-230VAC/3Ph/50-60Hz)
Airflow	1500CFM
Blower Fan Blade	Fan Blade Carbon impregnated Direct drive: 18” DIA., #18/10-10/45/PAGAS/3HR/JA
Fan Guard	Steel Powdercoated Condenser Fan Guard.
Fan Motor	Two Speed: 208-230VAC/3Ph/50-60Hz, with Internal Thermal Overload Protection.
Capacity Control	Discharge Bypass Valve with Liquid De-superheating expansion valve. Capacity control up to 100%.
Pressure Relief Valve	495 PSI, Auto Reset.
High Pressure Switch	Open At 425 PSI CO, Close at 325 PSI CI
Low Pressure Switch	Open at10 PSI CO, Close At 32 PSI CI,
Low Ambient Control (Fan Cycle Switch)	232 PSI Cut-in High Speed Fan, 160 Cut-out Low Speed Fan Low Ambient Control allow for operation in the Cooling Mode to 50°F (10°C)
Filter Drier	16 $inch^3$, Solid core filter media.
Sight Glass	Moisture Indicator, Viewable from outside the ECU

Refrigerant Access Ports	Suction & Discharge Access Valves: ¼ SAE Flare Connections with Schrader Valve and Cap, accessible from outside the ECU.
Condenser Coil (X2)	Aluminum Finned, 12 Fins per inch, 0.0075" thick fin stock, enhanced copper tube 0.015" thick wall, Face Area 2.84^{2}ft. each x 5 rows deep, E-Coating for corrosion protection.
Coil Guard	Aluminum Powdercoated "X" panel guard
EVAPORATOR	
Airflow	1700CFM @ 1.2" ESP, 1600 RPM
Blower Wheel	Backward Incline Direct Drive: 15.9" DIA., Welded Aluminum Blades
Blower Motor	Two Speed: 208-230VAC/1Ph/50-60Hz, with Internal Thermal Overload Protection. (Requires Capacitors of 12.5uF and 40uF for two speed operation)
TEV	Thermostatic Expansion Valve
Evaporator Coil	Aluminum Finned, 14 Fins per inch, 0.006" thick fin stock, enhanced copper tube 0.019" thick wall, Face Area 2.58^{2}ft. x 3 rows deep, E-Coating for corrosion protection.
Drain Pan	Sloped Drain Pan with Dual Drains to allow for condensate drainage and ECU operation @ 10° incline in any horizontal direction. The 1/2" FPT Drain Connections are located on the exterior lower side rails on each of the unit's sides.
Heating Elements	304 Stainless Steel Constructions, Qty. (3) Elements 2000Watts 208vac each.
Heater High Limits	Opens 135°F/ Closes 115°F Cut-in
Supply-air & Return-air grille and Air filter.	There is a Supply Air Register and a Return-air Grille. A cleanable air filter is secured behind the return air grille.
CONTROLS	
Contactors	IEC Type with Power Buss Feed with control relays
Control Transformer	208-240/3/50-60 VAC Primary, 24VAC Secondary 50VA
Evaporator Shut-off Solenoid Valve	208-240VAC 50-60, 0.19A Inrush, 0.9A Holding (Controlled by Freeze Stat. Thermostat.)
Phase Monitor	Monitor's Phase Loss and Phase Reversal. *(Note: Compressor cannot operate in phase reversal)*
Low Pressure By-pass Timer	Bypasses the low-pressure switch for 2 minutes to allow the system to start in the Cooling Mode during low ambient conditions. (Located in Remote Thermostat Controller.)
Anti-Short Cycle Timer	2 Minute on-delay/on-break timer to control compressor short cycling. (Located in Remote Thermostat Controller.)
Hour Meter	Records Total ECU Operating hours in the Fan and Auto Modes. It is viewable behind the control panel. (Requires screws to be removed for viewing)
Local Thermostat	N.A.

Mode Selector Switch	Rotary Snap Action Switch, OFF / FAN / HEAT/ COOL - Modes
High/Low Speed Blower	Toggle Switch- Operates the High and Low Evaporator Blower.
REMOTE CONTROL	
Model Selector Switch	Rotary Snap Action Switch, OFF / FAN / AUTO –Modes (Auto mode is for heating and cooling)
Remote Thermostat	Heating and Cooling Thermostat, with auto change over and remote thermal sensing bulb fully shielded and located externally on the remote box. With Digital Control to adjust temperature Setting in the HEAT & COOL Modes
(Optional) Remote cable, and Remote Box, Connector	#16 AWG, 10 Conductor Remote Cable with connector. *Note: High and Low Speed Evaporator Blower can be operated by the remote control*.

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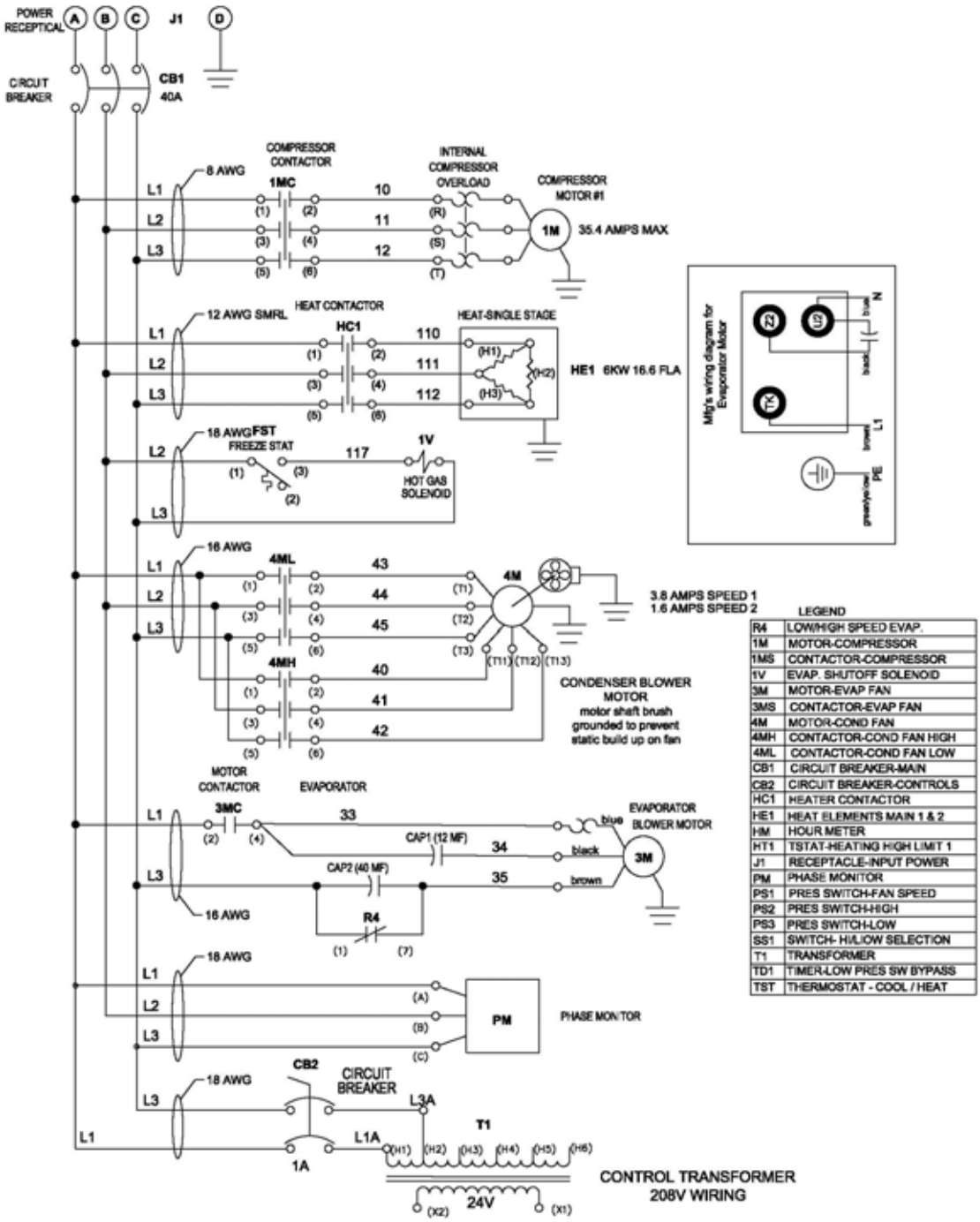
Section 9 drawings are organized to span the binding.

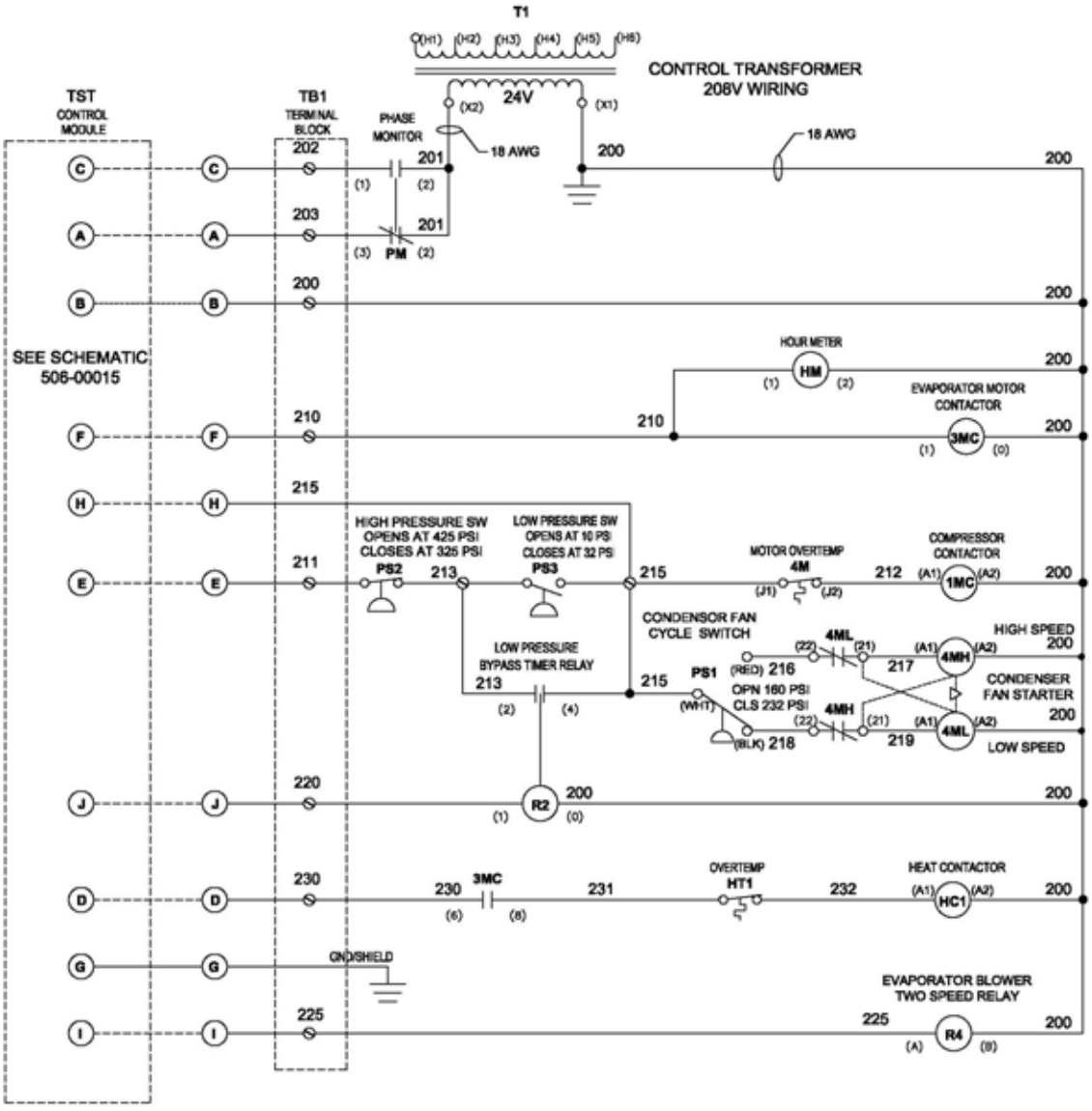
9 Reference Drawings

9.1 Main Schematic Diagram (506-00005)

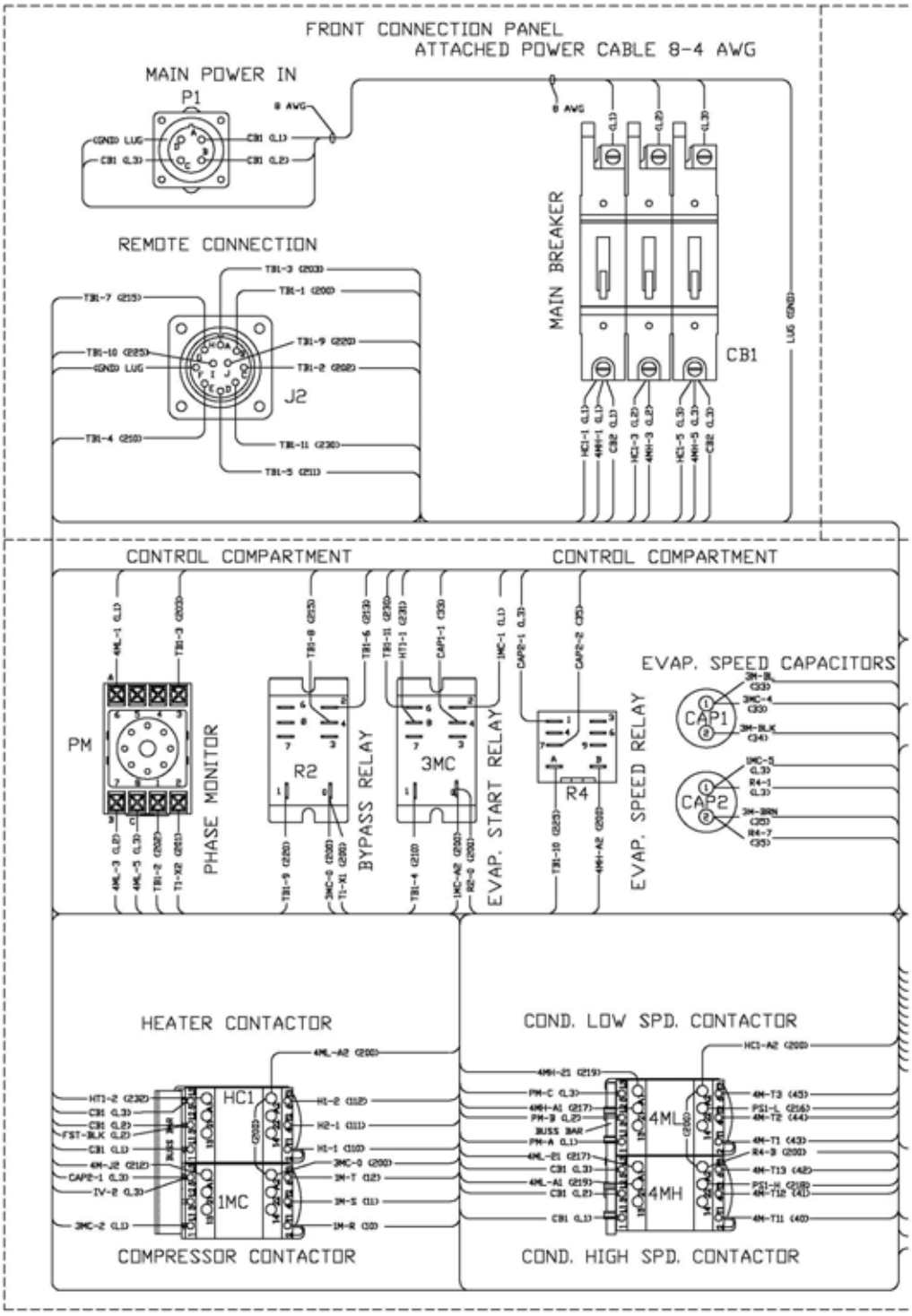


Drawing continued on next page.

Drawing 506-00005, continued from previous page.



9.2 Main Electrical Wire Diagram (514-00011)



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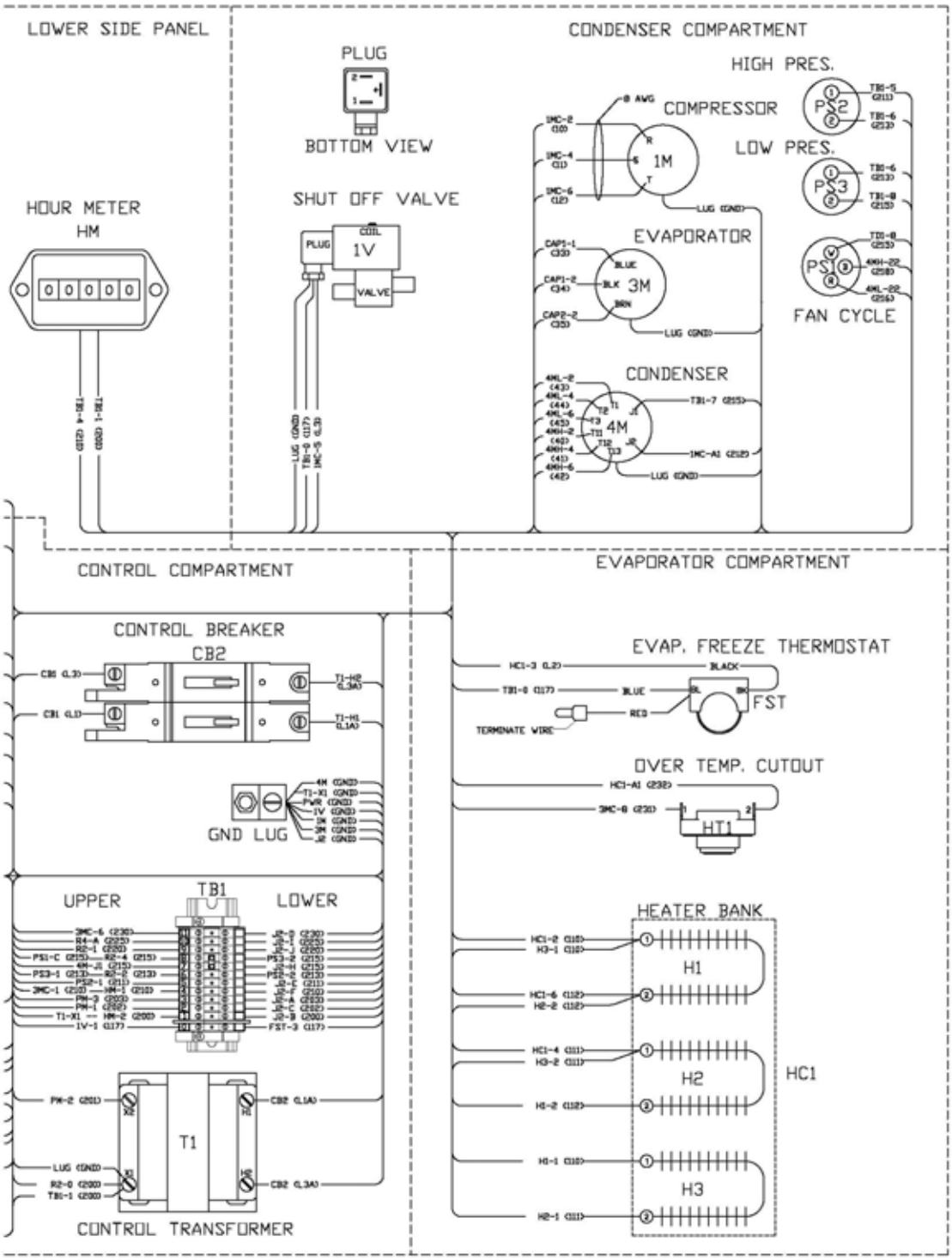
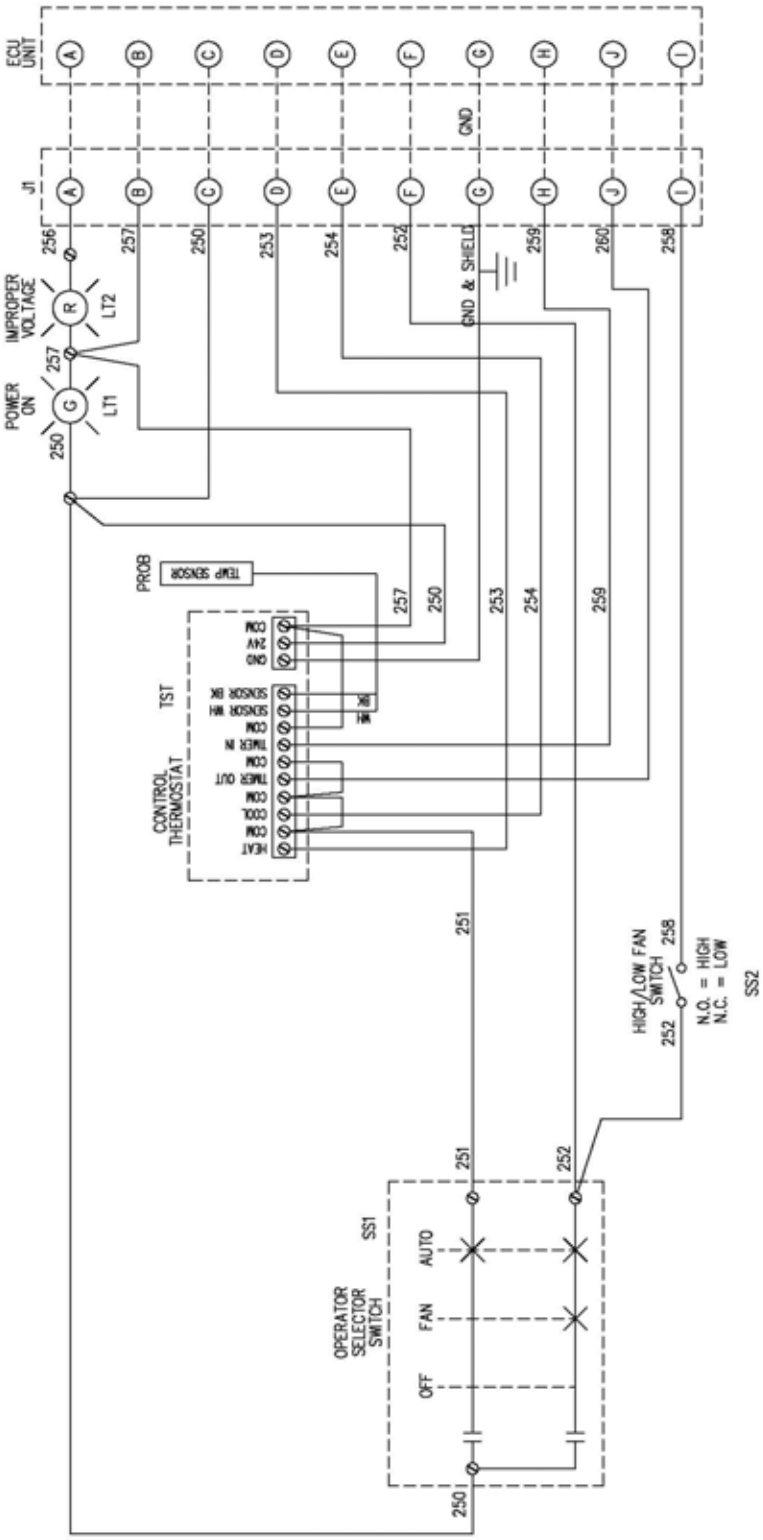
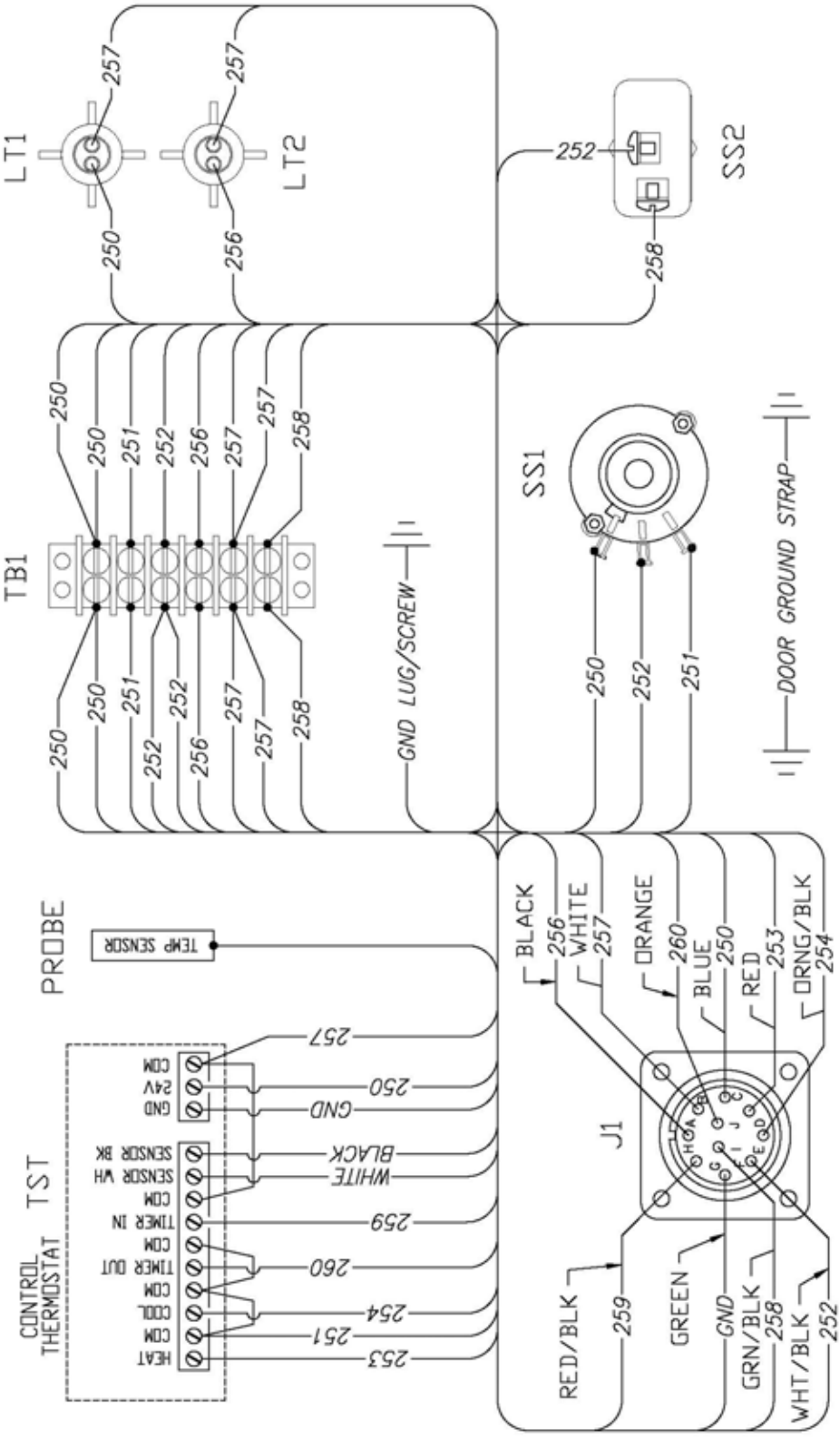
Drawing 514-00011, continued from previous page.



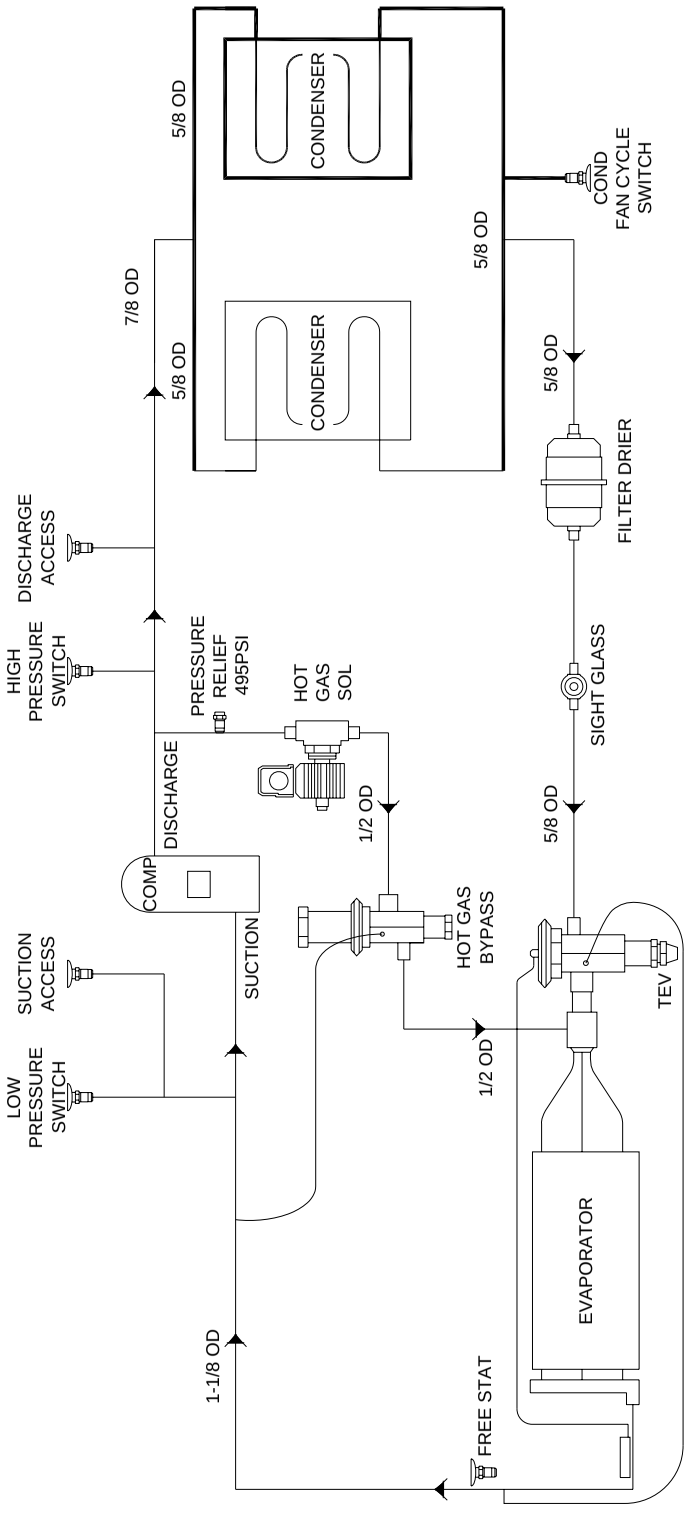
9.3 Remote Control Schematic Diagram (506-00015)



9.4 Remote Control Wiring Diagram (514-00006)



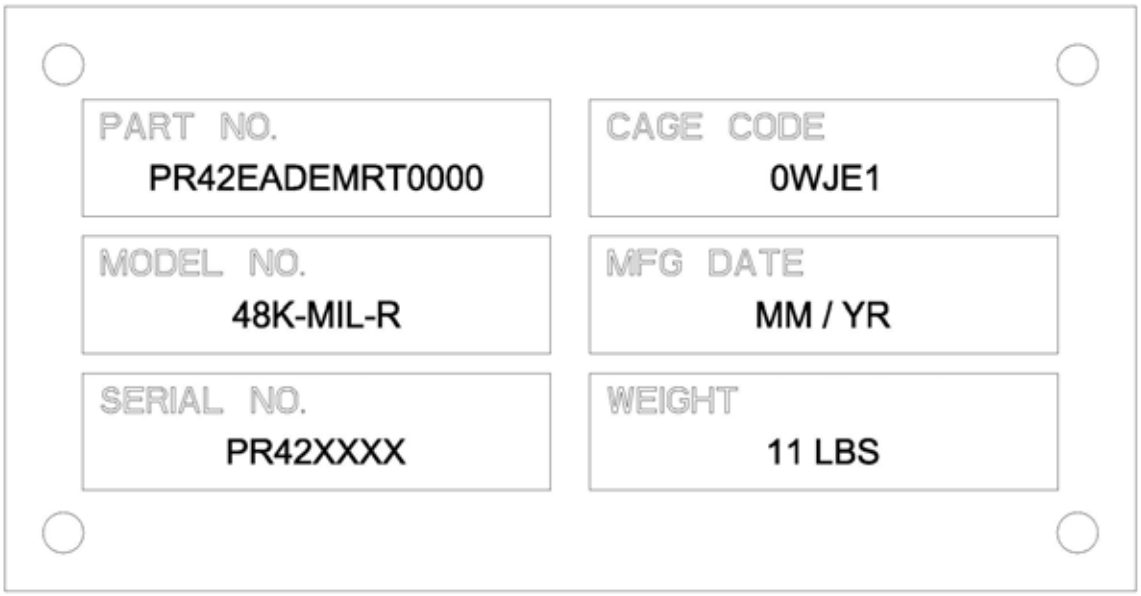
9.5 Refrigeration Schematic (520-00029)



9.6 ECU Main Data Plate (018-00266)

9.7 ECU Item Identification (018-00263)

9.8 Remote Main Data Plate (018-00265)



9.9 Remote Item Identification (018-00264)

10 Assembly Drawings and Parts List

NOTE: Parts that have a corrosion resistant finish, or are painted or powdercoated, will have a suffix appended to the part number to identify the finish. The assembly diagrams in most cases will identify the part without a specified finish. The suffix "–P1" identifies the part as finished Green per PER FED-STD-595 COLOR 34094, "-P2" identifies the part as finished Desert Tan PER FED-STD-595 COLOR 33446 &"-PW" for finish in White. These lists are all for a unit which is Desert Tan & White, for a Green & White unit the only parts that change are the "-P2" becomes a "-P1".

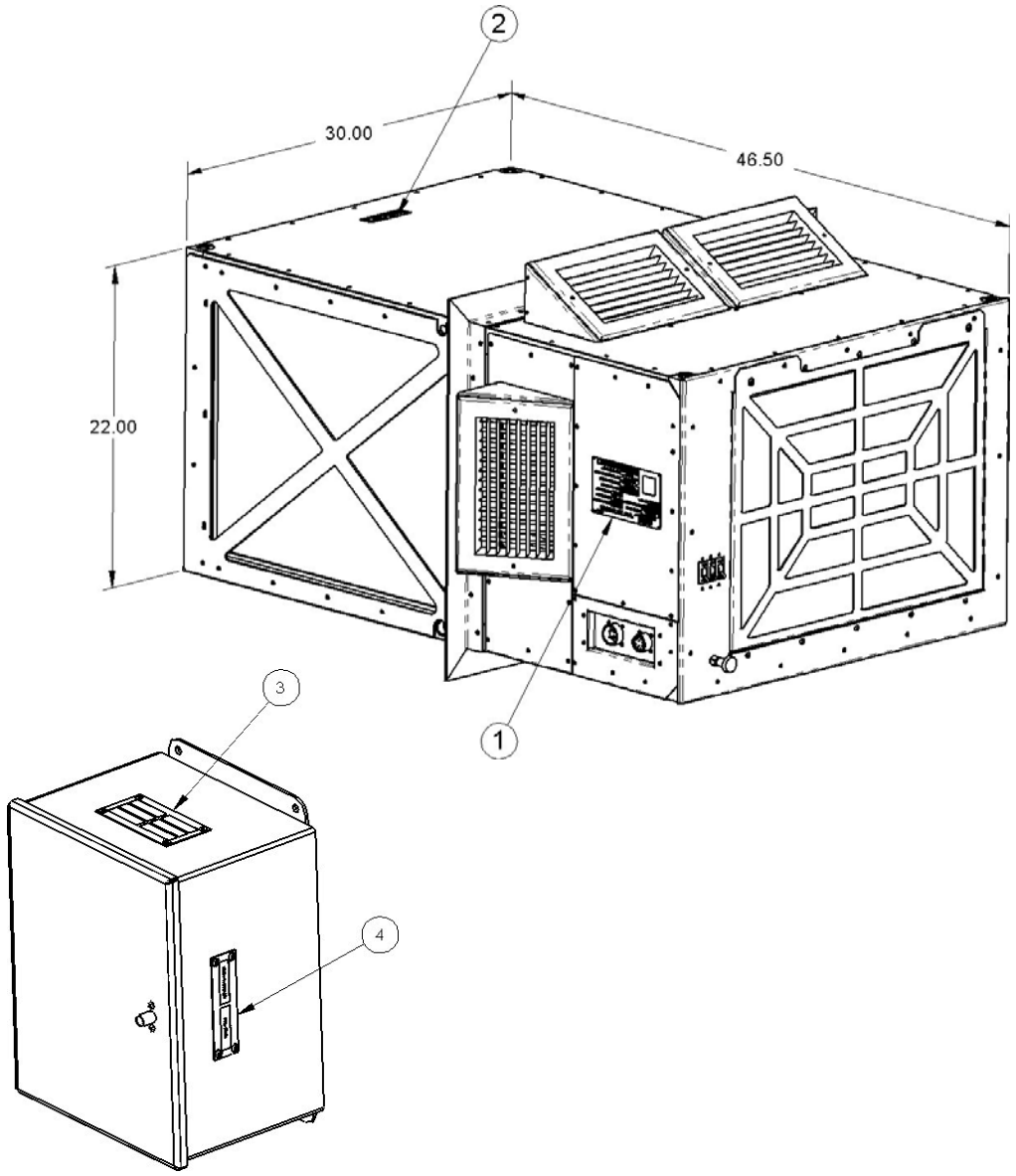
NAI PART NUMBER	DESCRIPTION	QTY/ECU
	SHEETMETAL PARTS	
230-00018AB-P2	FILTER CLIP	2
230-00018AO-P2	PANEL	1
230-00018BB-P2	FRAME PLATE	1
230-00018C-P2	FRAME PLATE	1
230-00018CA-P2	FRAME PLATE	1
230-00018FE-P2	FRAME BULKHEAD	1
230-00018FJ-PW	FRAME ANGLE	1
230-00018FK-PW	FRAME ANGLE	1
230-00018FR-PW	FILTER GRILLE SUPPORT	1
230-00018FX-P2	BRACKET	1
230-00018HG-P2	BRACKET	1
230-00018KB-PW	EVAP GAP FILLER	1
230-00018M-P2	TEST PORT RECESS	1
230-00018PA-PW	FRONT PANEL	1
230-00018PB-P2	CONDENSER END COVER	1
230-AAR18PC-P2	CONDENSER TOP COVER	1
230-00018PD-P2	CONDENSER BOTTOM COVER	1
230-00018PE-P2	CONDENSER GRILLE	2
230-00018PH-PW	EVAPORATOR PARTITION	1
230-00018PL-PW	EVAP SIDE COVER	1
230-AAR18PM-PW	EVAP LEFT FRONT COVER	1
230-00018PN-PW	EVAP SIDE COVER	1
230-00018PP-PW	EVAPORATOR BOTTOM PANEL	1
230-00018PR-PW	BRACKET-HOURMETER	4
230-00018PS-PW	BRACKET-HOURMETER	1
230-00018PT-PW	EVAPORATOR TOP COVER	1
230-00018PU-PW	EVAPORATOR BOTTOM COVER	1
230-00018PW-PW	FILTER GRILLE	1
230-00018ZF-P2	BRACKET-MTG COMP HEADBAND	1
230-00018ZH-P2	BULKHEAD STIFFENER AND MOTOR BRACKET	1
230-00018TA-P2	FRAME PLATE	1

	EVAPORATOR SECTION COMPONENTS	
011-00117	T-STAT-DISC	1
015-00067	HOURMETER	1
025-00153E	COIL–EVAP. EPOXY FIN COATED	1
054-00003	LATCH-SNAP A-1-S LUDWIG	2
057-00044	GRILLE- 10" X 6" DOUBLE DEFLECTION	4
059-00023	CABLE-CONTROL ASSY	1
071-00045	BLOWER-MOTORIZED	1
087-00005	FILTER-METAL 18x23x1	1
087-00008	FILTER-METAL 3-1/4x8-3/4x3/4	1
230-00018-A9	EVAP. BULKHEAD ASSY	1
230-00018-A16	DRAIN PAN ASSY	1

	CONDENSOR SECTION COMPONENTS	
011-00101	SWITCH-LOW PRESS	1
011-00108	SWITCH-HIGH PRESS	1
011-00150	SWITCH-COND FAN CYCL	1
019-00066	BOOT	1
023-00001	VALVE-SCHRADER	2
025-00154E	COIL-COND EPOXY FIN COATED	1
025-00155E	COIL-COND EPOXY FIN COATED	1
040-00142	MOTOR- 1HP, 2 SPEED	1
048-00013	PAD-VIBRATION ISOLATION	1
051-00008	STRUT NUT	4
057-00047	GUARD-FAN, 18" DIA	1
070-00045	FAN BLADE- 18.00 DIA	1
072-00033-P2	RING-FAN 18" CONDENSER	1
100-00009-BA	COMPRESSOR MOUNT	4
230-00018-A7-P2	FRESH AIR BOX ASSY	1
250-00028DP	CLAMP, BAND 9-1/8 DIA	1

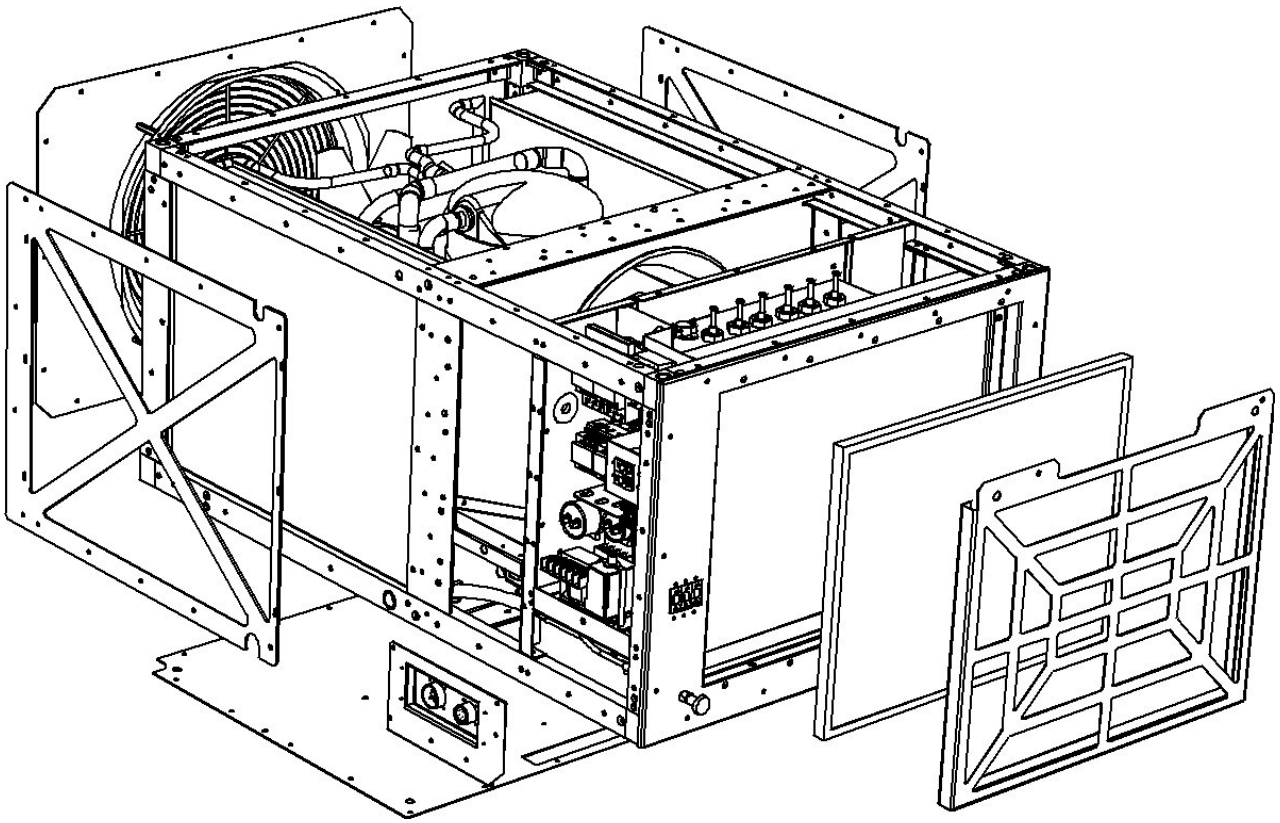
	MISC. HARDWARE & GROMMETS	
017-00115	CORD GRIP 1/2"	2
017-00116	CORD GRIP 3/4"	1
017-00116N	LOCKNUT 3/4"	2
017-00117	CORD GRIP 3/4"	1
017-00116B	BUSHING	2
060-00008	GROMMET- 5/8 ID	1
060-00041	GROMMET- 1/2 ID	1
060-00058	GROMMET- 3/4 ID	2
060-00060	GROMMET- 1 1/8 ID	1
060-00067	GROMMET-RED SILICON 0.91"	3
060-00069	GROMMET-RED SILICON 1.50"	3

230-00018-AM, MAIN ASSEMBLY, ID PLATES

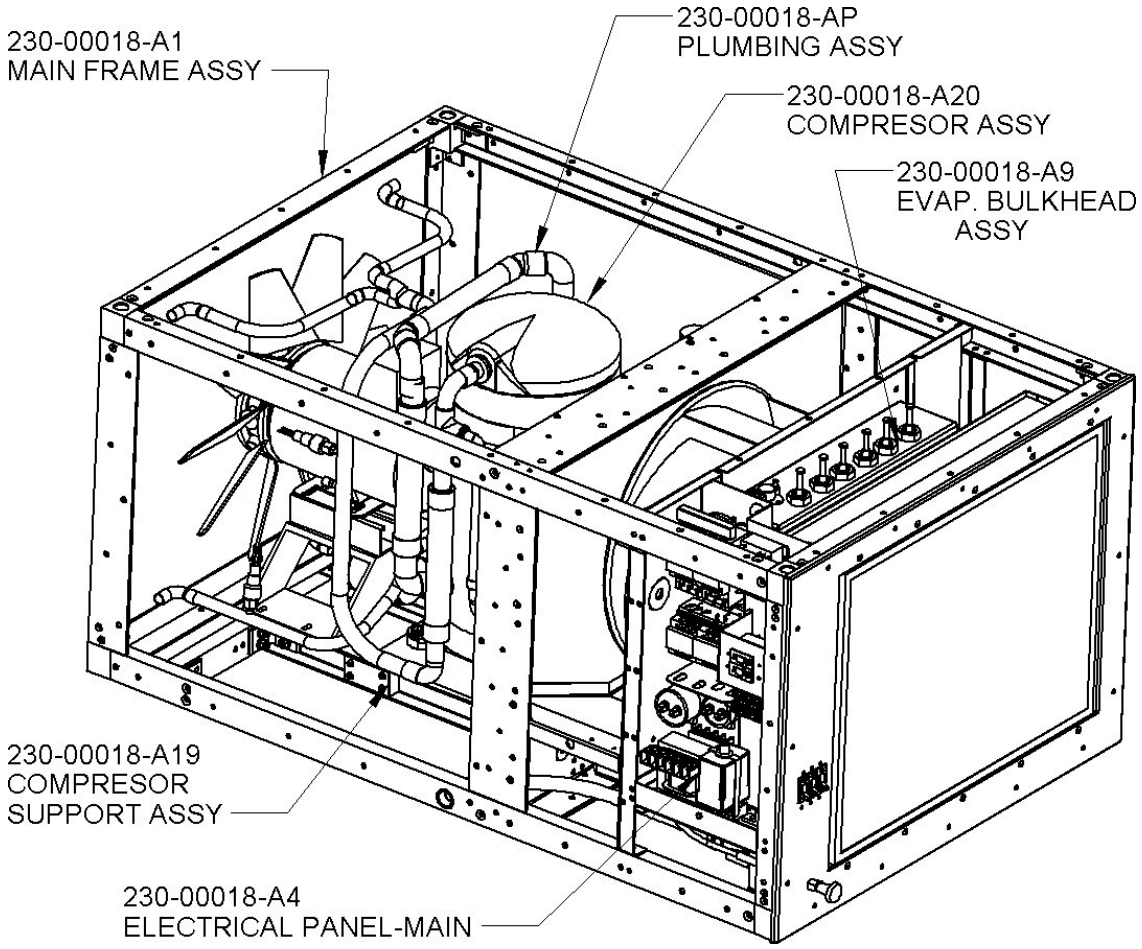


ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	018-00266	PLATE-ID, 48K, ARMOR HOLDINGS	1
2	018-00263	TAG, 48K ECU, ARMOR HOLDINGS	1
3	018-00265	PLATE-ID, REMOTE CONTROL	1
4	018-00264	PLATE-ID, 48K, REMOTE	1
NOT SHOWN	FS-00429	RIVET-POP, 1/8" SS	4/EACH PLATE

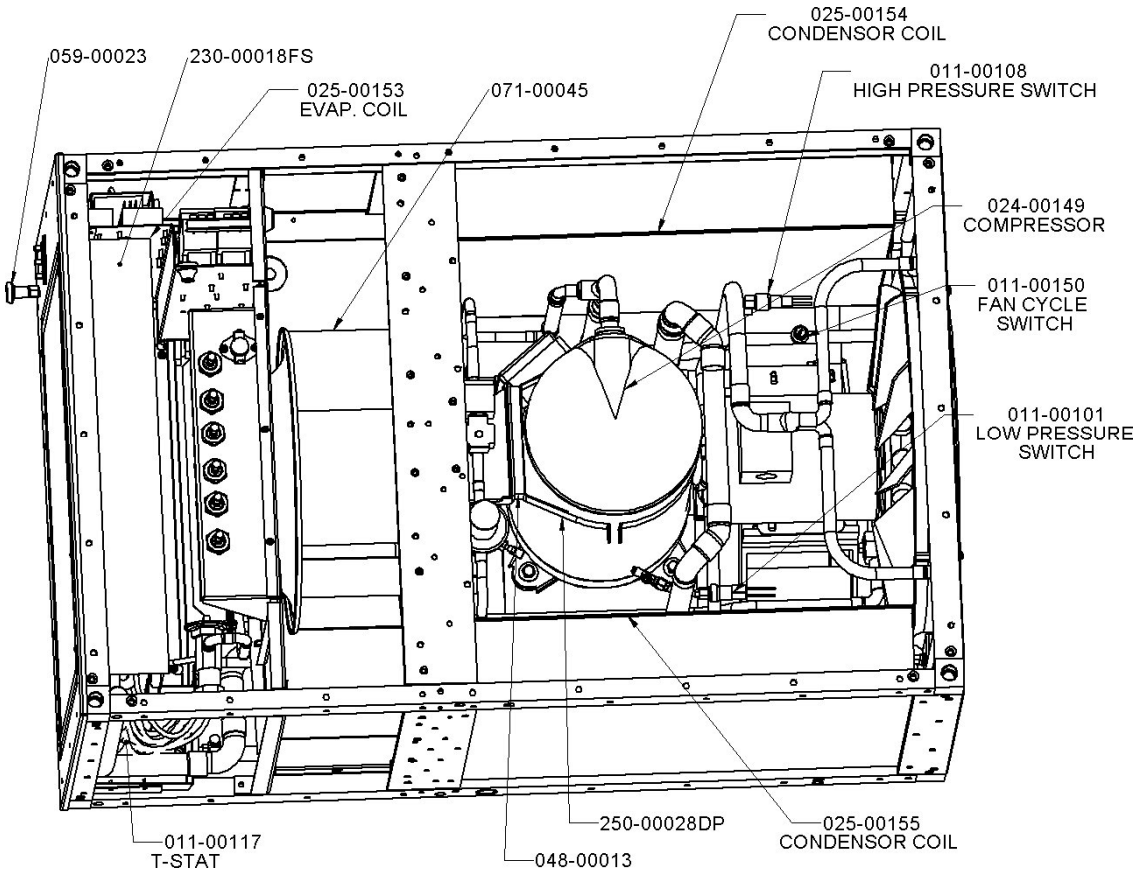
230-00018-AM, MAIN ASSEMBLY, PAGE 1 OF 3

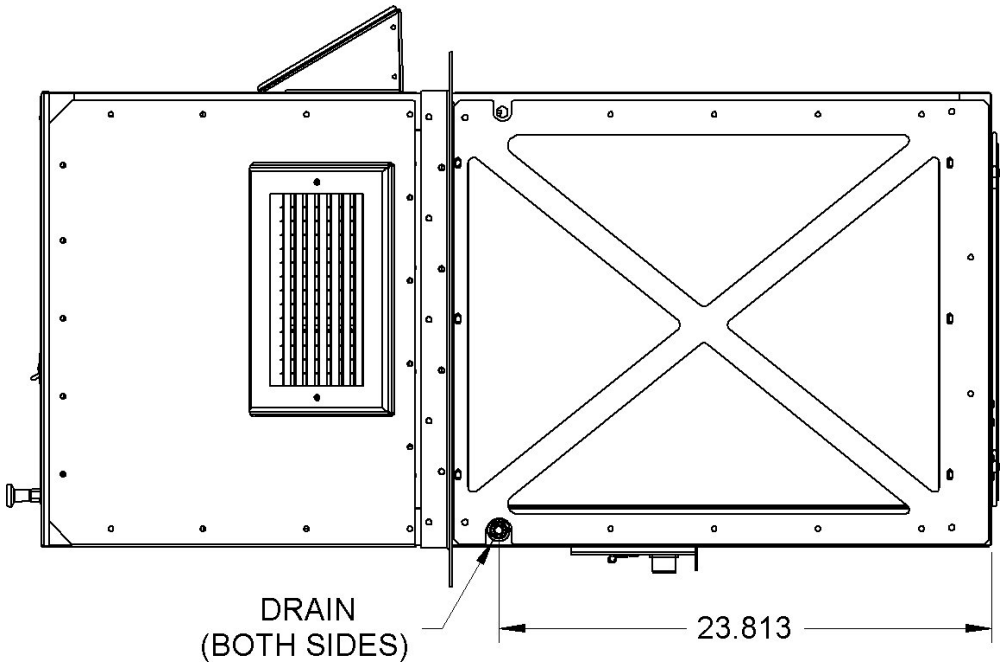


230-00018-AM, MAIN ASSEMBLY, PAGE 2 OF 3

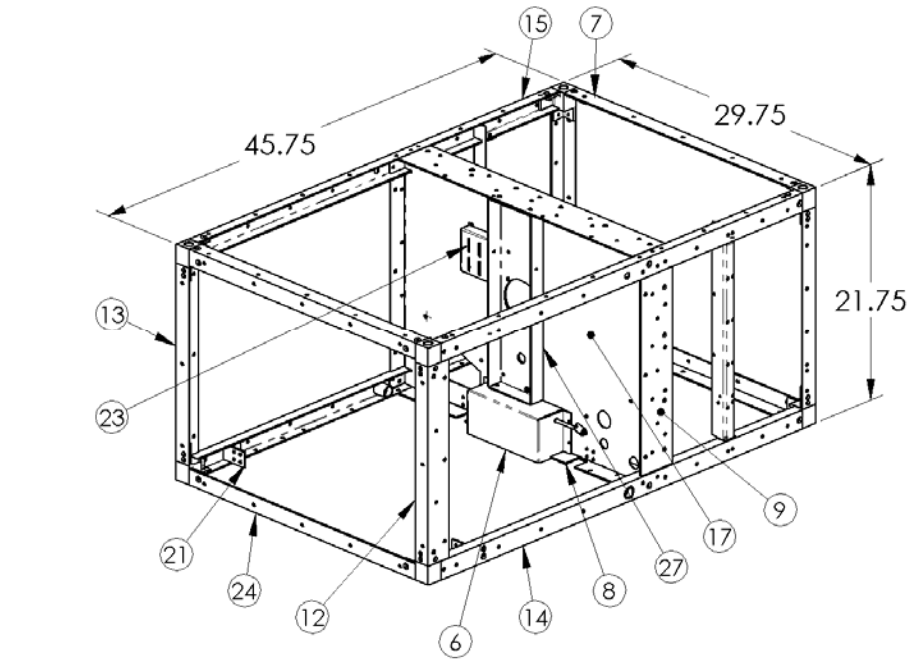


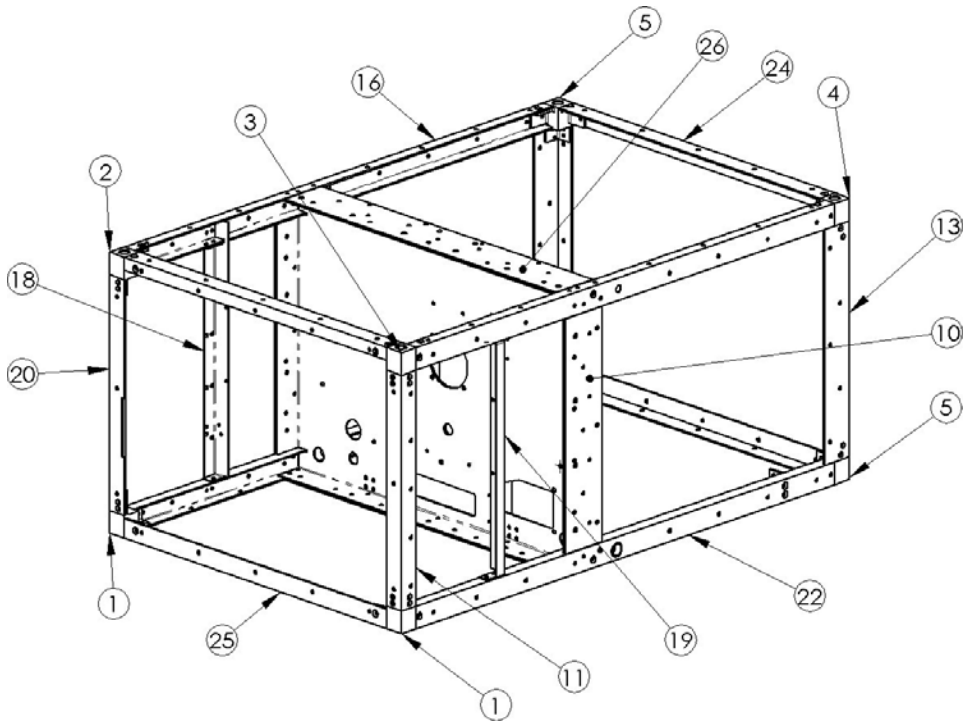
230-00018-AM, MAIN ASSEMBLY, PAGE 3 OF 3





230-00018-A1, MAIN FRAME ASSEMBLY, PAGE 1 OF 2

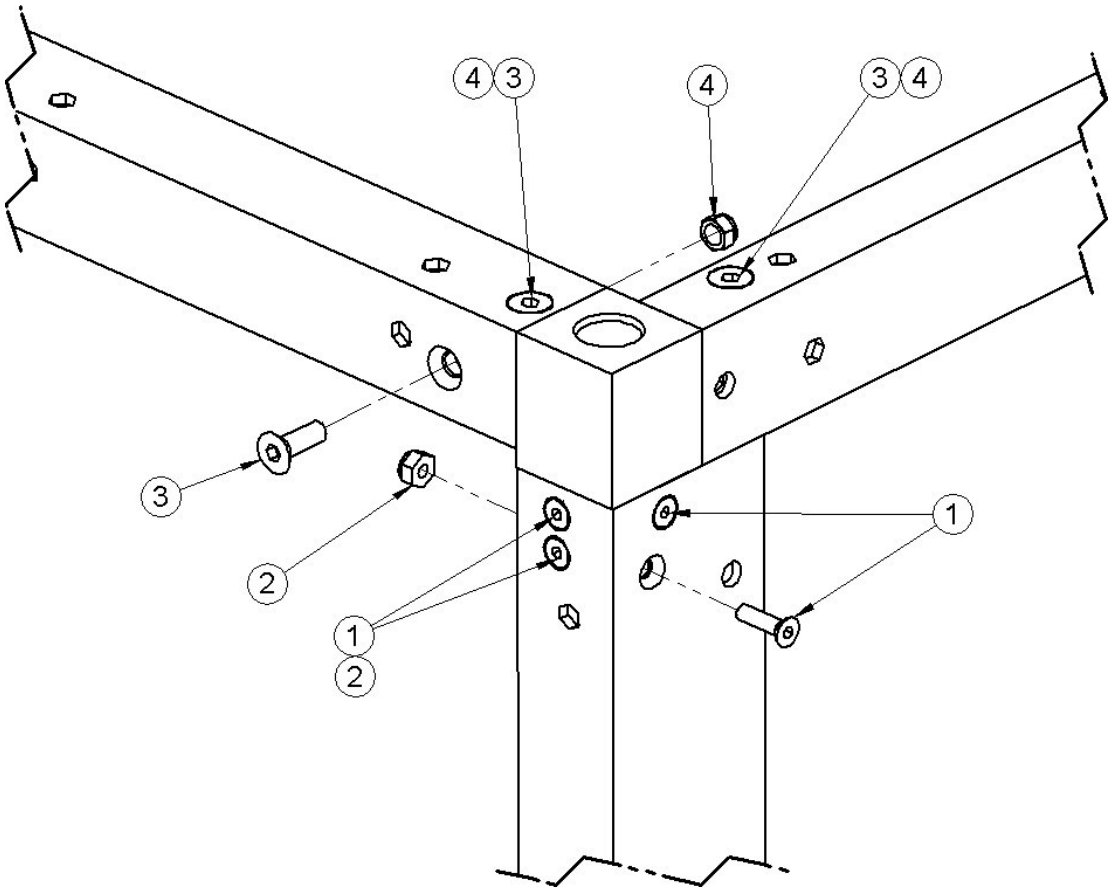




230-00018-A1, MAIN FRAME ASSEMBLY, PAGE 2 OF 2

ITEM NO.	PART NUMBER	DESCRIPTION	QTY
1	109-00064-PW	CORNER BLOCK	2
2	109-00065-PW	CORNER BLOCK	1
3	109-00066-PW	CORNER BLOCK	1
4	109-00110-P2	CORNER BLOCK	2
5	109-00111-P2	CORNER BLOCK	2
6	230-00018-A7	FRESH AIR BOX ASSY.	1
7	230-00018AL-PW	FRAME ANGLE	1
8	230-00018BB-P2	FRAME PLATE	1
9	230-00018C-P2	FRAME PLATE	1
10	230-00018CA-P2	FRAME PLATE	1
11	230-00018D-PW	FRAME ANGLE	1
12	230-00018DA-P2	FRAME ANGLE	1
13	230-00018DB-P2	FRAME ANGLE	1
14	230-00018FA	FRAME CHANNEL	1
15	230-00018FB-PW2	FRAME CHANNEL	1
16	230-00018FC-PW2	FRAME CHANNEL	1
17	230-00018FE-P2	FRAME BULKHEAD	1
18	230-00018FJ-PW	FRAME ANGLE	1
19	230-00018FK-PW	FRAME ANGLE	1
20	230-00018FM-PW	FRAME ANGLE	1
21	230-00018FU-P2	ANGLE BRACKET	2
22	230-00018G	FRAME CHANNEL	1
23	230-00018HG-P2	TXV VALVE BRACKET	1
24	230-00018K-P2	FRAME ANGLE	2
25	230-00018KA-PW	FRAME ANGLE	1
26	230-00018TA-P2	FRAME PLATE	1
27	230-00018ZH-P2	MOTOR BRACKET	1

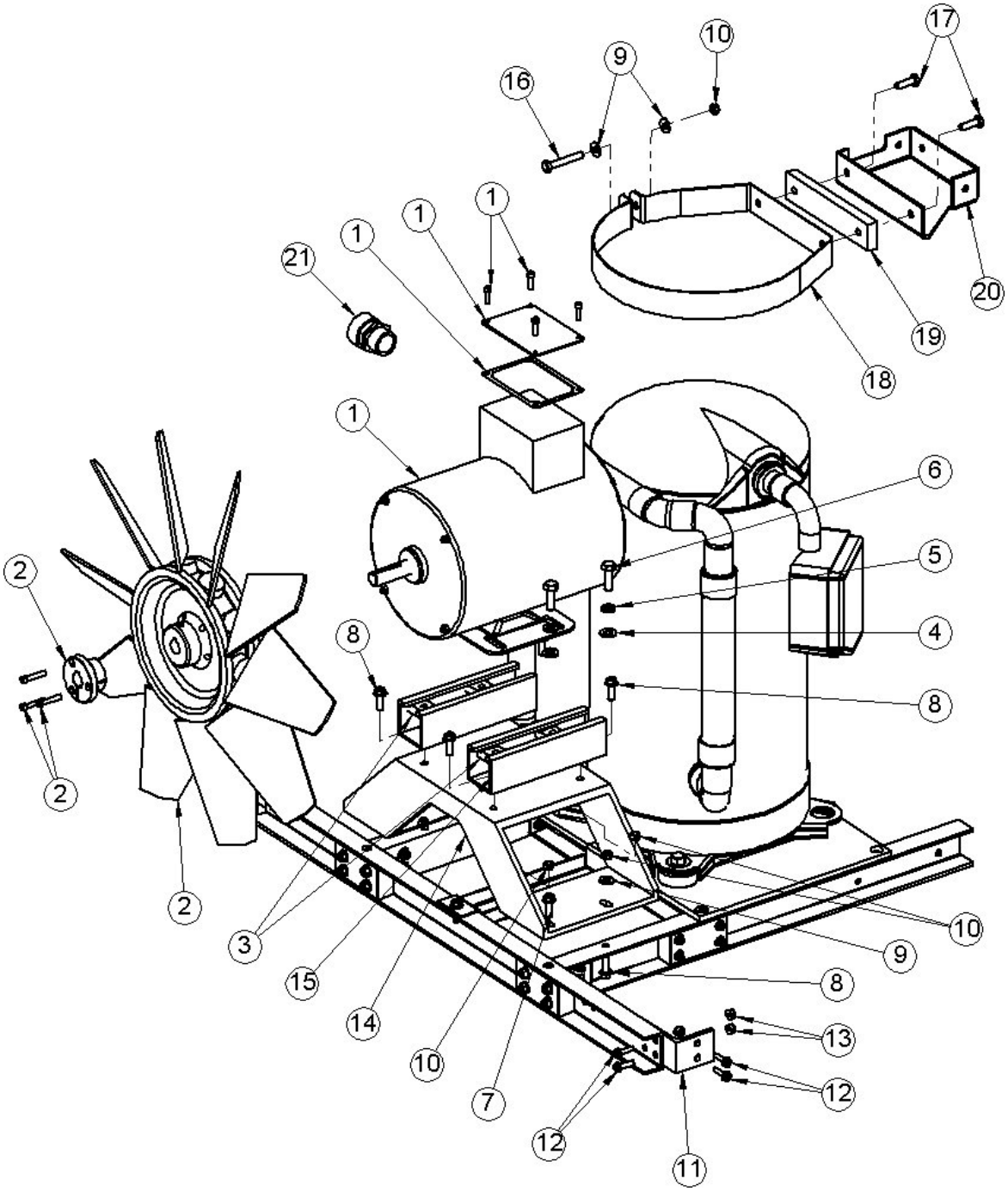
230-00018-A1, MAIN FRAME ASSEMBLY, CORNER BLOCKS, DETAIL



TYPICAL: 8 CORNERS

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	FS-00432	SCREW #10-24 x 3/4" FLAT SOCK	4
2	FS-00375	NUT #10-24 NYLON LOCKNUT SS.	4
3	FS-00677	BOLT- 1/4-20 X 3/4" FHSCS, SS	3
4	FS-00242	NUT- 1/4-20 NYLON LOCKNUT SS.	3

230-00018-A1, MAIN FRAME ASSEMBLY, CONDENSOR MOTOR, DETAIL, PAGE 1 OF 2



NOTE:
INSTALATION HARDWARE TO FRAME: (ITEM 11; 12; 13).

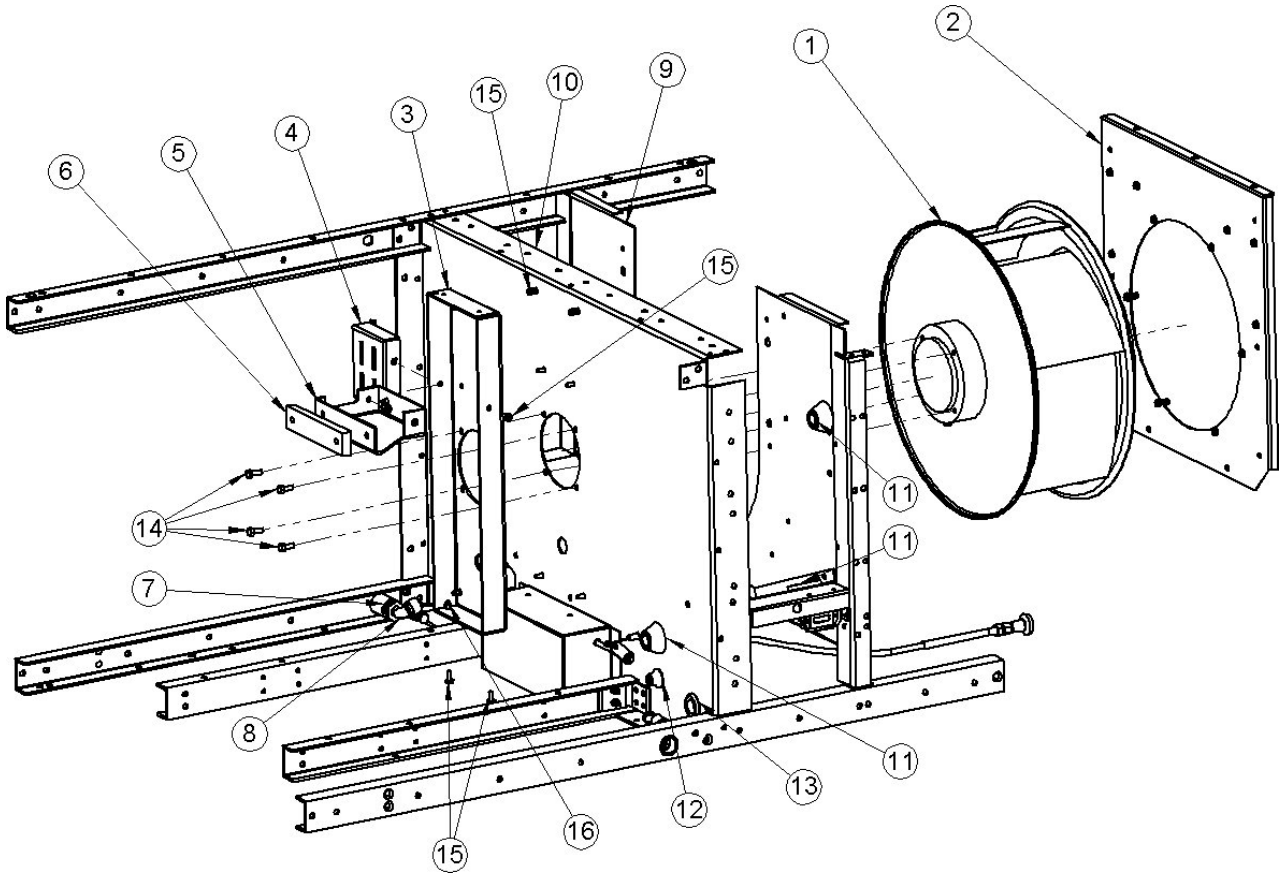
230-00018-A1, MAIN FRAME ASSEMBLY, CONDENSOR MOTOR, DETAIL, PAGE 2 OF 2

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	040-00142	MOTOR 1HP	1
2	070-00045	FAN BLADE - 18.00 DIA	1
3	051-00008	RELASTRUT NUT, 5/16-18	4
4	FS-00024	FLAT WASHER-5/16" SS	4
5	FS-00025	LOCKWASHER -5/16" SS	4
6	FS-00037	BOLT- 5/16-18 X 1"HH	4
7	FS-00699	SCREW- 1/4-20X 5/8"	2
8	FS-00192	SCREW- 1/4-20X 3/4"	6
9	FS-00022	FLAT WASHER-1/4" SS	4
10	FS-00242	NUT- 1/4-20 NYLON LOCKNUT	6
11	230-00018FU-P2	FRAME CLIP ANGLE	2
12	FS-00383	SCREW- 10-24X 3/4", SLOT HEX	8
13	FS-00375	NUT- 10-24 NYLON LOCKNUT	8
14	230-00018MJ-P2	BASE-MOTOR MOUNTING	1
15	230-00018MK-P2	MOTOR, STRUT MOUNT	2
16	1/4-20; 1-3/4	BOLT- 1/4-20 X 1-3/4"SS HEX	1
17	1/4-20; 7/8	BOLT- 1/4-20 X 7/8"SS HEX	2
18	250-00028DP	CLAMP, BAND 9-1/8 DIA. SS.	1
19	048-00013	PAD-VIBRATION	1
20	230-00018ZF-P2	BRACKET-HEADBAND	1
21	017-00132	CORD GRIP 1/2" NYLON	1

NOTE:
ADDITIONAL PARTS ARE INCLUDED WITH: ITEM 1 (040-00142 MOTOR 1HP)
** KEY 3/16 X 3/16 X 1-3/8 (QTY=1); GASKET (QTY=1); SCREWS (QTY=4)

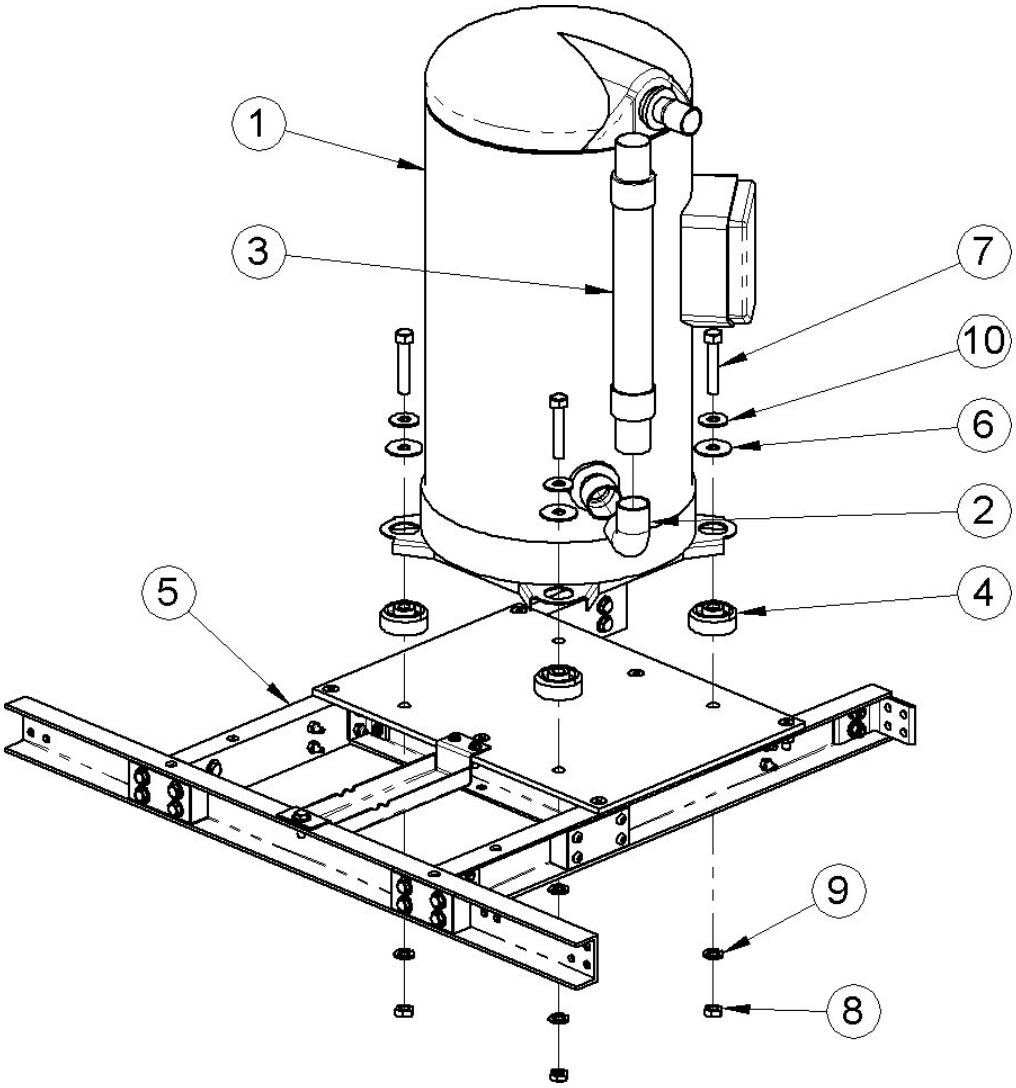
ADDITIONAL PARTS ARE INCLUDED WITH: ITEM 2 (070-00045 FAN BLADE)
** FAN BLADE BUSHING (QTY=1); MOUNTING SCREWS 10-24 X 1” (QTY=4)

230-00018-A1, MAIN FRAME ASSEMBLY, EVAPORATOR MOTOR, DETAIL,



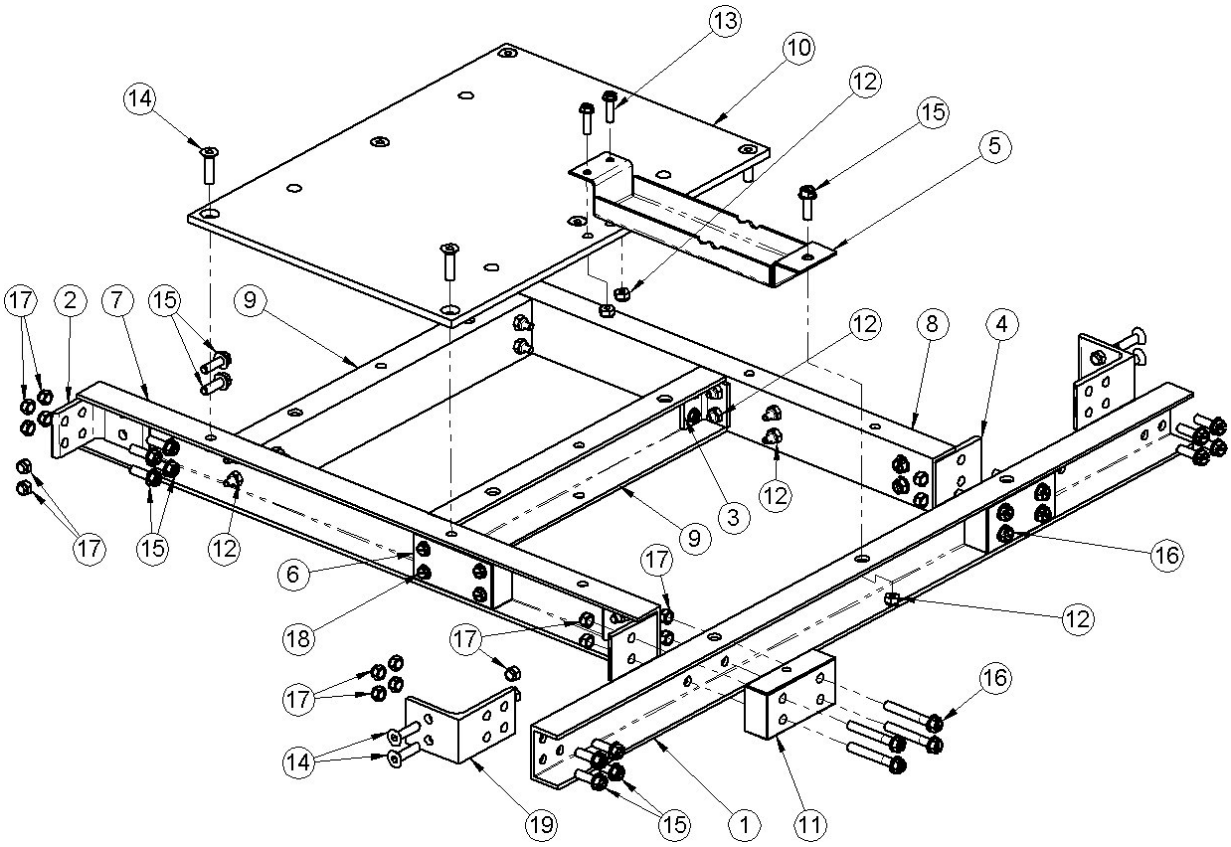
ITEM NO.	PART NUMBER	DESCRIPTION	QTY
1	071-00045	BLOWER- MOTORIZED	1
2	230-00018PF-PW	VORTEX MOUNT	1
3	230-00018ZH-P2	MOTOR BRACKET	1
4	230-00018HG-P2	TXV VALVE BRACKET	1
5	230-00018ZF-P2	BRACKET-HEADBAND	1
6	048-00013	PAD-VIBRATION	1
7	030-00168	COUPLING-FULL, ALUM. 1/2" NPT	2
8	030-00185	BARBED ADAPT 90EL 1/2"MPTx1/2"	2
9	230-00018PH-PW	EVAPORATOR PARTITION	1
10	230-00018FE-P2	FRAME BULKHEAD	1
11	060-00069	GROMMET-RED SILICON 1.50"	3
12	060-00058	GROMMET- 3/4 ID	2
13	060-00067	GROMMET-RED SILICON 0.91"	1
14	FS-00478	SCREW-M6-1.0 X 16mm LG	4
15	FS-00382	SCREW- #10-24 x 1/2" SLOT HEX	12
16	FS-00341	RIVNUT-HEX 10-24 THREAD	12

230-00018-A20, COMPRESOR ASS'Y



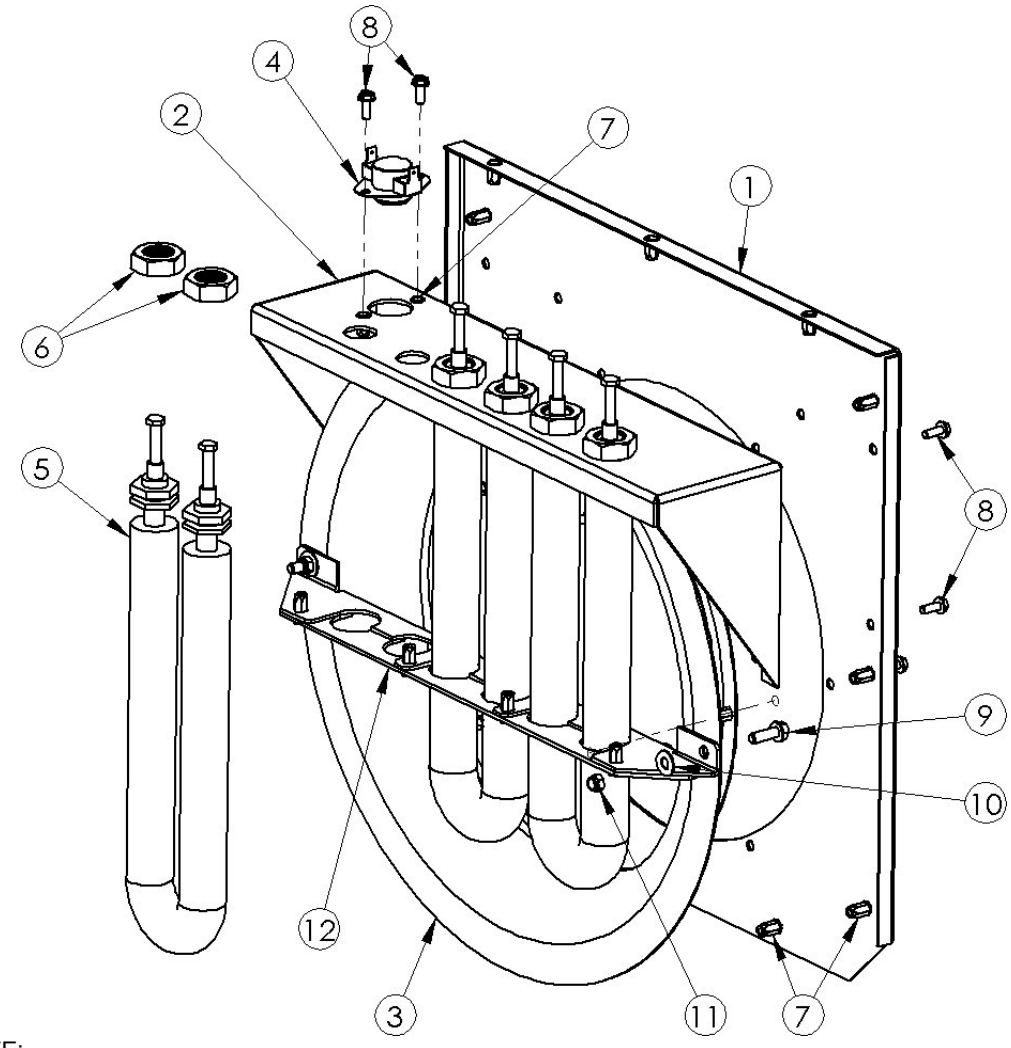
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	024-00149	COMPRESSOR - COPELAND	1
2	031-00048	ELBOW- 1-1/8" 90 DEG	1
3	048-00005	VIBRATION ABSORBER- 1 1/8"	1
4	100-00009	SPACER	4
5	230-00018-A19	COMPRESOR SUPPORT ASS'Y	1
6	FS-00032	FLATWASHER- 3/8" SS	4
7	FS-00081	BOLT- 3/8-16 x 2" HH, SS	4
8	FS-00092	NUT, HEX - 3/8-16 SS	4
9	FS-00430	LOCKWASHER- 3/8" SS	4
10	FS-00431	FLATWASHER- 3/8" SS	4

230-00018-A19, COMPRESOR SUPPORT ASS'Y



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	230-00018AF-P2	CHANNEL-SUPPORT	1
2	230-00018FD-P2	FRAME CLIP ANGLE	2
3	230-00018FH-P2	FRAME CLIP ANGLE	4
4	230-00018FT-P2	FRAME CLIP ANGLE	2
5	230-00018FX-P2	FILTER/DRYER SUPPORT	1
6	230-00018FZ	CONNECTION BLOCK	2
7	230-00018J-P2	CHANNEL	1
8	230-00018JB-P2	CHANNEL	1
9	230-00018L-P2	COMPRESSOR SUPPORT	2
10	230-00018LA-P2	COMPRESSOR PLATE	1
11	230-00018XX	CONNECTION BLOCK	2
12	FS-00375	NYLOCK NUT, SS, 10-24	27
13	FS-00383	SCREW- #10-24 x 3/4" SLOT HEX	14
14	FS-00654	SCREW, 1/4-20 X 1" SKT FLT HD	10
15	FS-00192	1/4-20 x 3/4 BOLT, HEX WASHER	25
16	FS-00700	1/4-20 x 1-3/4 BOLT, HEX WASHER	8
17	FS-00242	NYLOCK NUT, SS, 1/4-20	36
18	FS-00701	10-24 x 1-1/2 HEX, WASH SCREW, SS	8
19	230-00018FU	ANGLE BRACKET	2

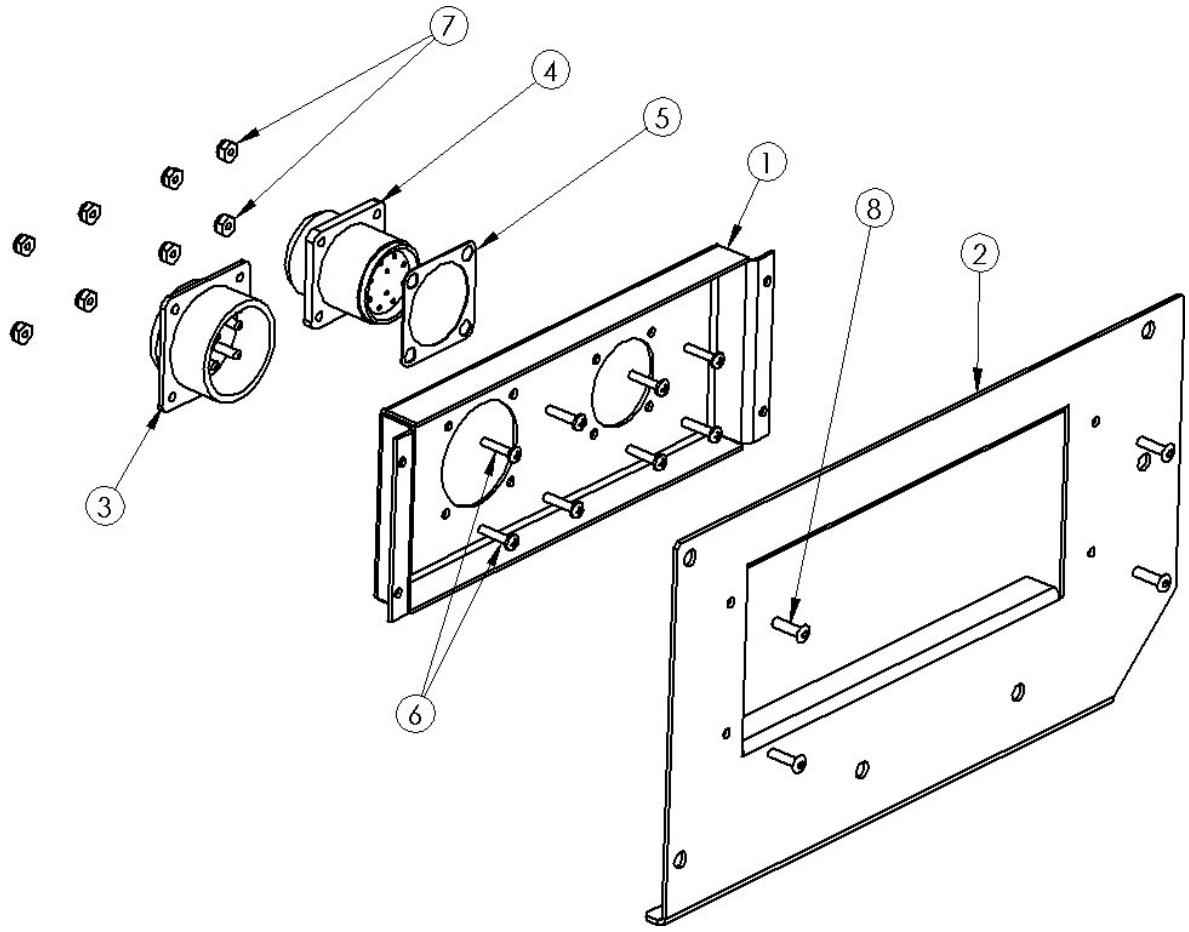
230-00018-A9, EVAP. BULKHEAD ASS'Y.



NOTE:
ITEM #5 MOUNTING HARDWARE IS INCLUDED WITH THE HEATERS.

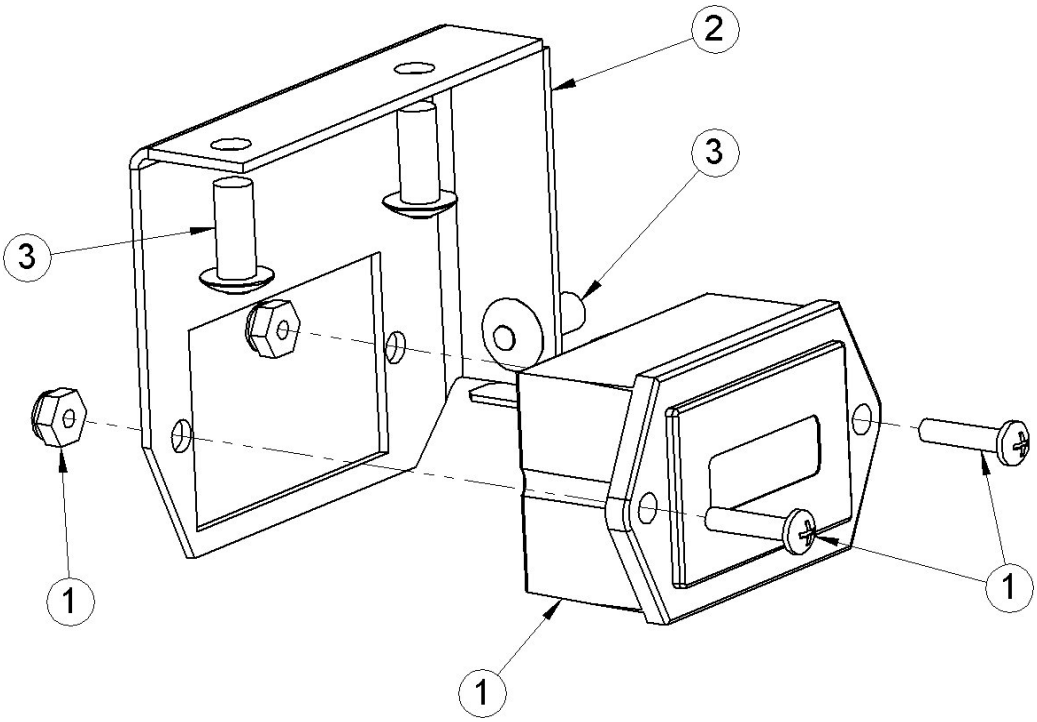
ITEM NO.	PART NUMBER	DESCRIPTION	QTY
1	230-00018PF-PW	VORTEX MOUNT	1
2	230-00018PZ-PW	HEATER BRACKET	1
3	072-00032	INLET RING	1
4	011-00009	T-STAT- SNAP DISC	1
5	010-00047	HEATER, ELECTRIC, 2KW, 208V	3
6	051-00005	3/4-16 HEX JAM NUT	6
7	FS-00341	RIVNUT-HEX 10-24	25
8	FS-00382	SCREW- #10-24 x 1/2" SLOT HEX	14
9	FS-00699	1/4 x 5/8 BOLT, HEX WASHER	2
10	FS-00022	FLATWASHER- 1/4" 18-8 STAINLESS	2
11	FS-00242	NYLOCK NUT, SS, 1/4-20	2
12	230-00018PX	HEATER VIBRATION STOP	1

230-00018-A3, CONNECTION ASS'Y.



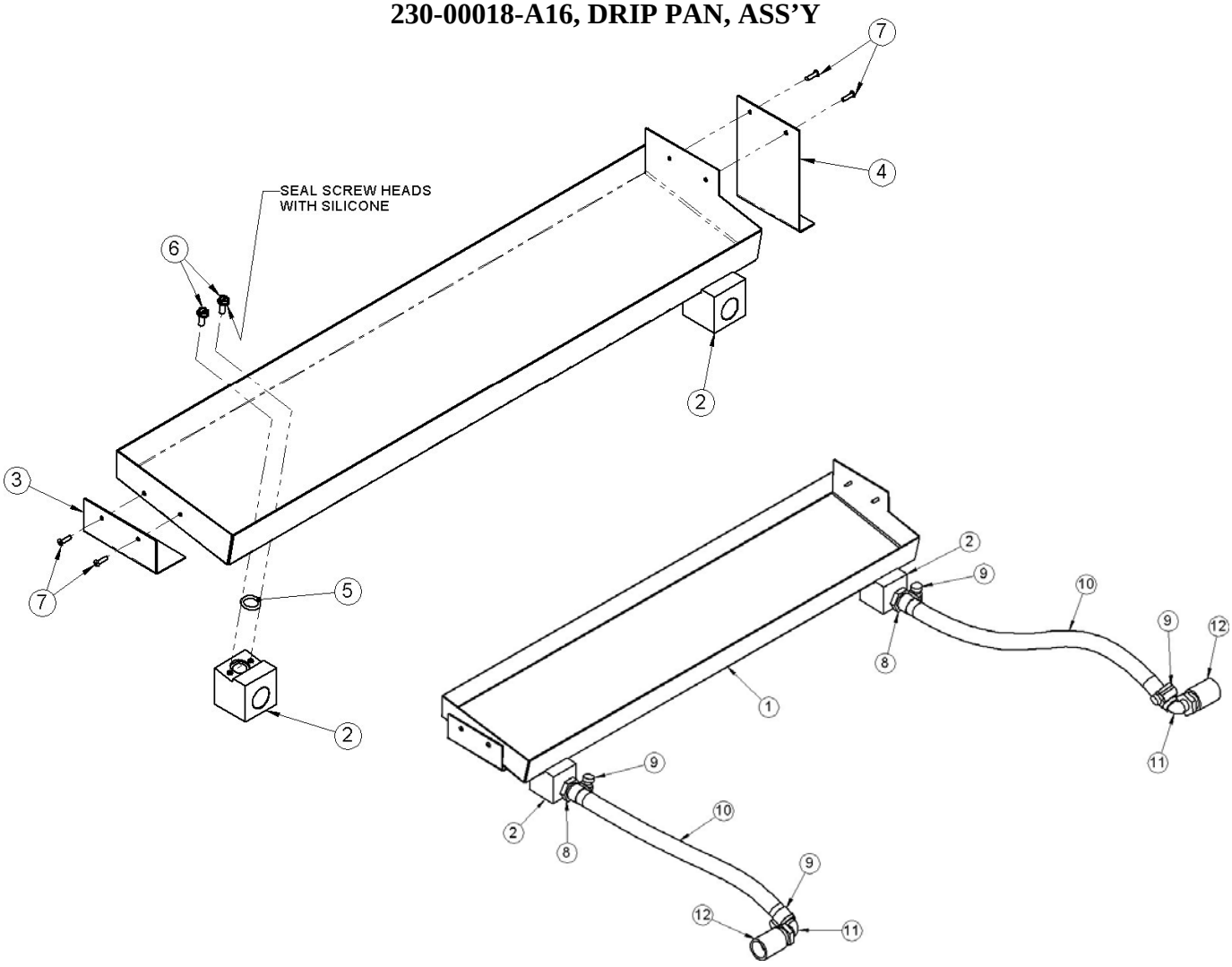
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	230-00018S-PW	PLUG PANEL INSET	1
2	230-00018R-PW	PLUG PANEL	1
3	108-00019	POWER CABLE	1
4	108-00020	CONTROL CABLE	1
5	017-00102G	GASKET-SHIELDING	1
6	#4-40 x 500	SCREW- #4-40 x 1/2" PHIL	8
7	FS-00415	NYLOCK NUT, SS, 4-40	8
8	FS-00339	RIVET-POP, 1/8" DIA.	4

230-00018-AM, HOUR METER ASS'Y, DETAIL



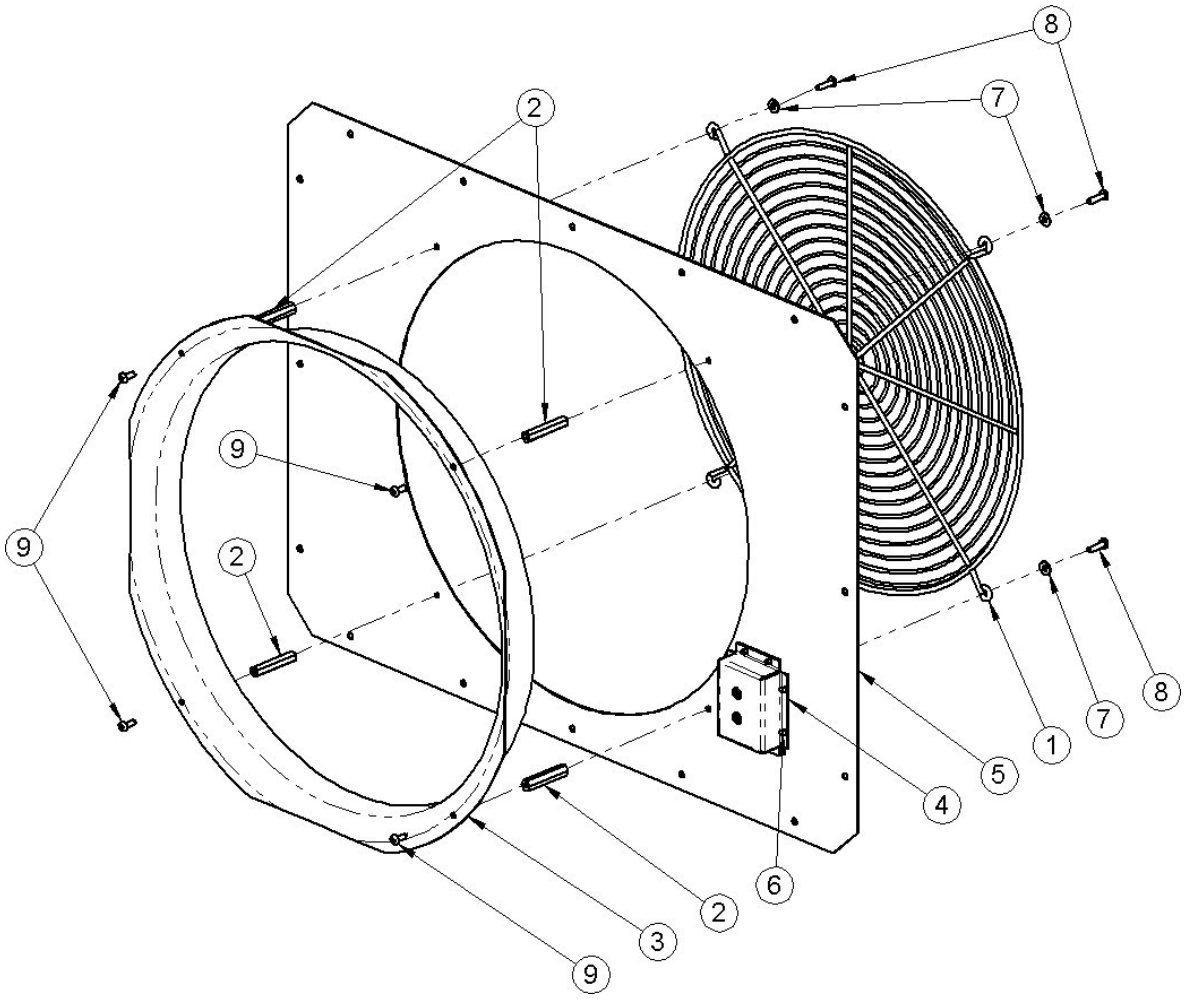
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	015-00067	HOURMETER	1
2	230-00018PS-PW	BRACKET, HOURMETER	1
3	FS-00315	3/16 POP RIVET	3

230-00018-A16, DRIP PAN, ASS'Y



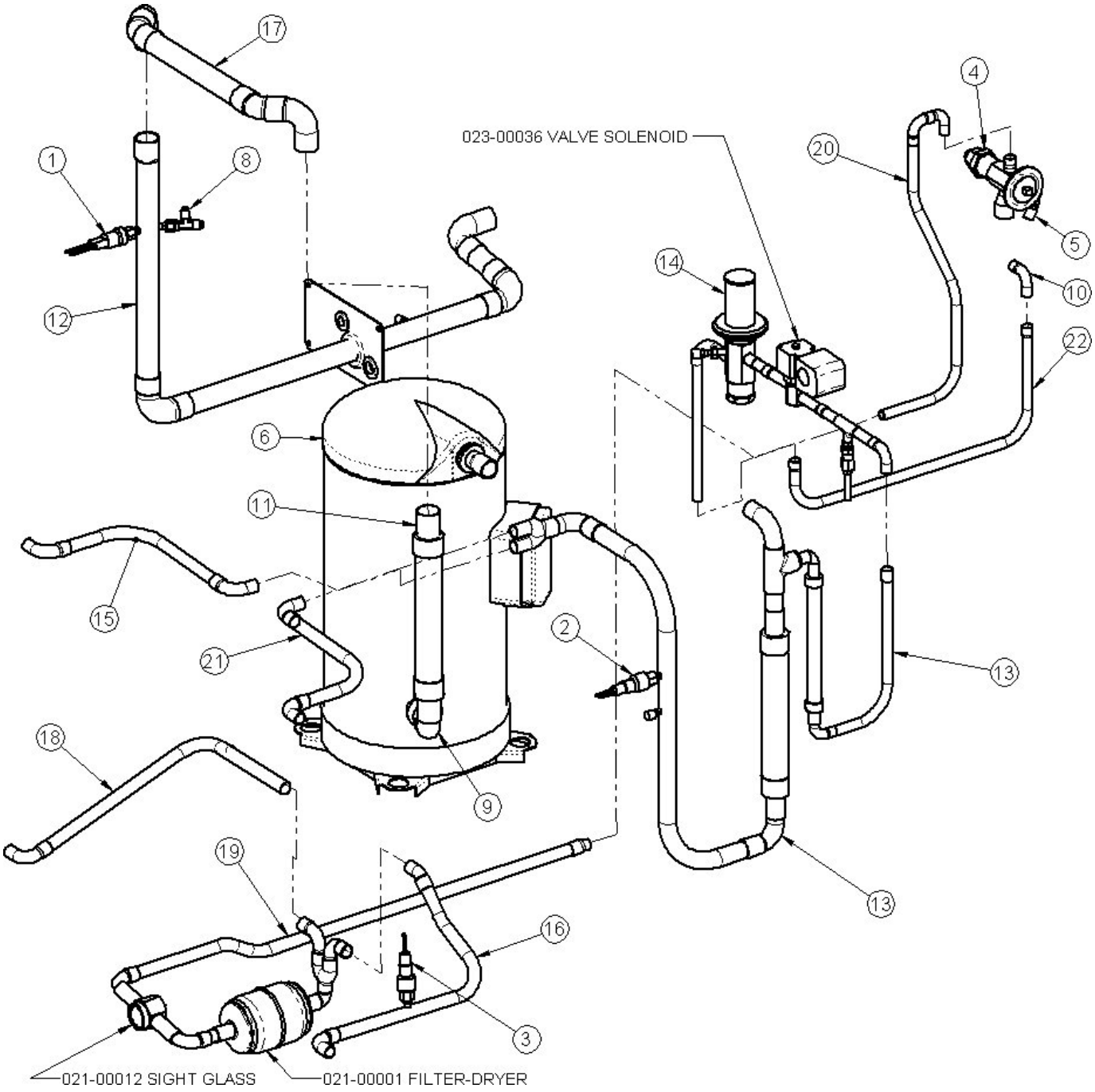
ITEM NO.	PART NUMBER	DESCRIPTION	QTY
1	104-00007	DRAIN PAN	1
2	230-00018BK	DRAIN PAN FITTING	2
3	230-00018ZC-PW	DRAIN PAN CLIP	1
4	104-00007C	DRAIN PAN CLIP	1
5	060-00088	O-RING - 1/2" ID X 11/16 OD	2
6	FS-00382	SCREW- #10-24 x 1/2" SLOT HEX	4
7	FS-00339	RIVET-POP, 1/8" DIA. ALUM/ALUM.	4
8	030-00187	BARBED ADAPT STRT 1/2"MPTx1/2"	2
9	056-00015	CLAMP- HOSE 1/2" - 1-1/16" X	4
10	FS-00498	TUBING-.500 ID .750 OD X 0.125	2
11	030-00185	BARBED ADAPT 90EL 1/2"MPTx1/2"	2
12	030-00168	COUPLING-FULL, ALUM. 1/2" NPT	2

230-00018-A17, REAR PANEL, ASS'Y



ITEM NO.	PART NUMBER	DESCRIPTION	QTY
1	057-00047	GUARD-FAN	1
2	059-00025	STANDOFF 10-32 THD	4
3	072-00033	RING	1
4	230-00018M-P2	TEST PORT RECESS	1
5	230-00018PB-P2	CONDENSER END COVER	1
6	FS-00139	RIVET - 3/16 X 1/4 GRIP S.S.	8
7	FS-00140	FLATWASHER - #10, #10NWSFS/COMM	4
8	FS-00295	SCREW- #10-32 x 3/4" PHIL PAN HD	4
9	FS-00666	SCREW- #10-32 x 1/2" PHIL PAN HD	4

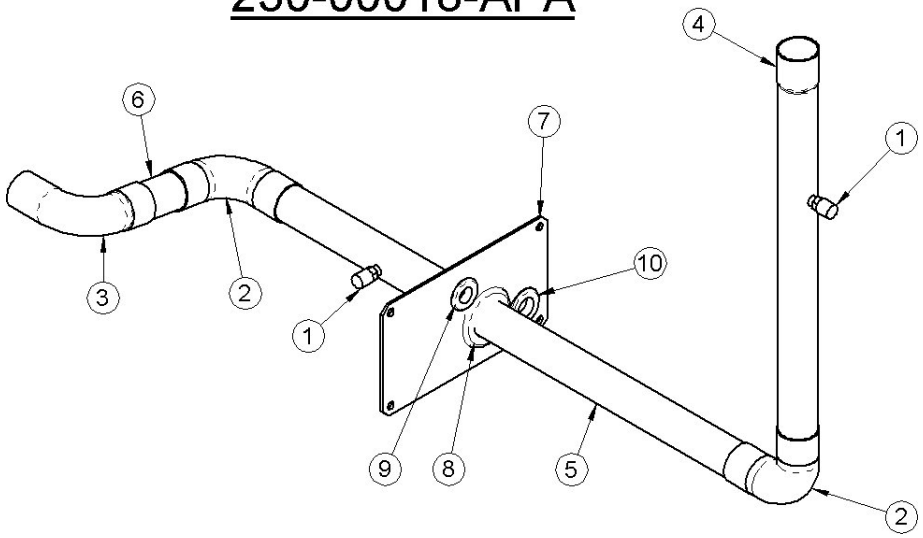
230-00018-AP, PLUMBING ASS'Y, PAGE 1 OF 2



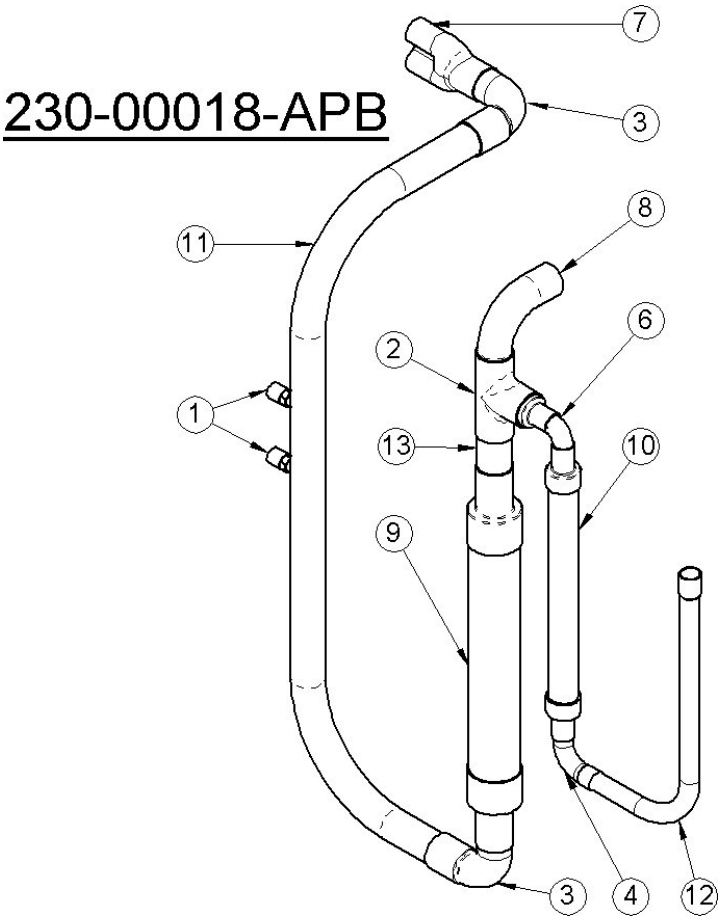
230-00018-AP, PLUMBING ASS'Y, PAGE 2 OF 2

ITEM NO.	PART NUMBER	DESCRIPTION	QTY
1	011-00101	SWITCH-LOW PRESS. P100AP	1
2	011-00108	PRESSURE SWITCH	1
3	011-00150	PRESS SWITCH - COND CYCLE	1
4	022-00043	TXV W/CAPILLARY TUBE	1
5	023-00001	VALVE - SCHRADER	1
6	024-00149	COMPRESSOR - COPELAND	1
7	025-00154	COIL - CONDENSER	1
8	030-00022	TEE- 1/4", #4-R6X-S RUN TEE	1
9	031-00048	STEET ELL SHORT RAD 1-1/8 FTG TO FTG	1
10	031-00106	ELBOW - 1/2" 90 DEG FxC L.R.	1
11	048-00005	VIBRATION ABSORBER 1 1/8"	1
12	230-00018-APA	ASS'Y PLUMBING RUN-A	1
13	230-00018-APB	ASS'Y PLUMBING RUN-B	1
14	230-00018-APD	ASS'Y PLUMBING RUN-D	1
15	230-00018-APE	ASS'Y PLUMBING RUN-E	1
16	230-00018-APF	ASS'Y PLUMBING RUN-F	1
17	230-00018-APG	ASS'Y PLUMBING RUN-G	1
18	230-00018-APH	ASS'Y PLUMBING RUN-H	1
19	230-00018-APJ	ASS'Y PLUMBING RUN-J	1
20	230-00018-APK	ASS'Y PLUMBING RUN-K	1
21	230-00018-APM	ASS'Y PLUMBING RUN-M	1
22	ACR-48K-12	1/2" OD X15" LONG	1

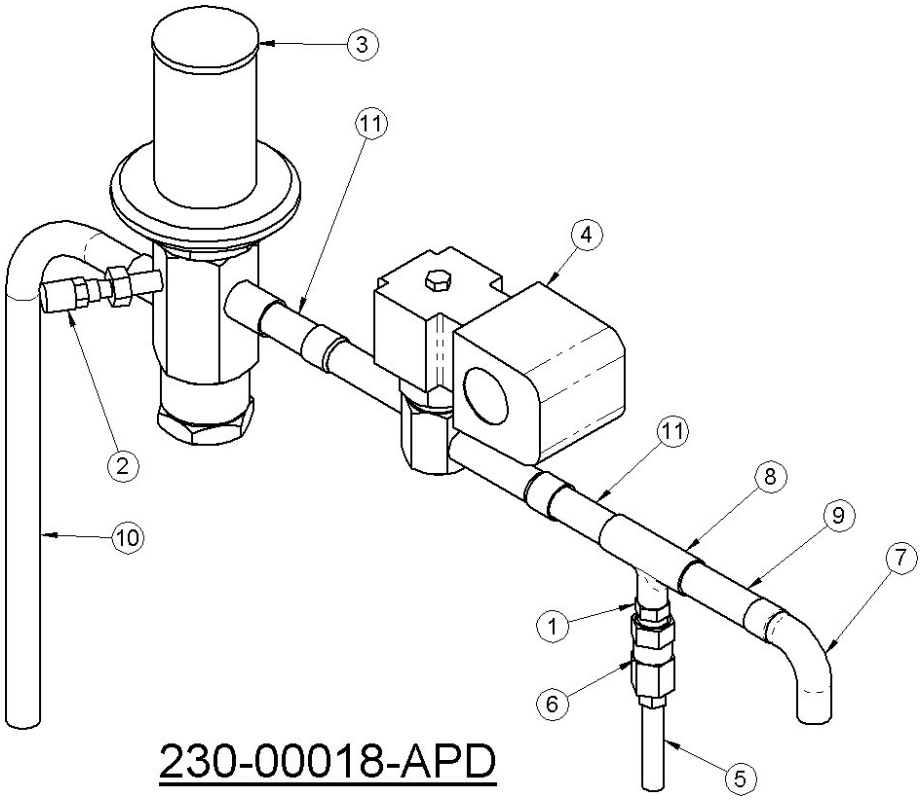
230-00018-APA



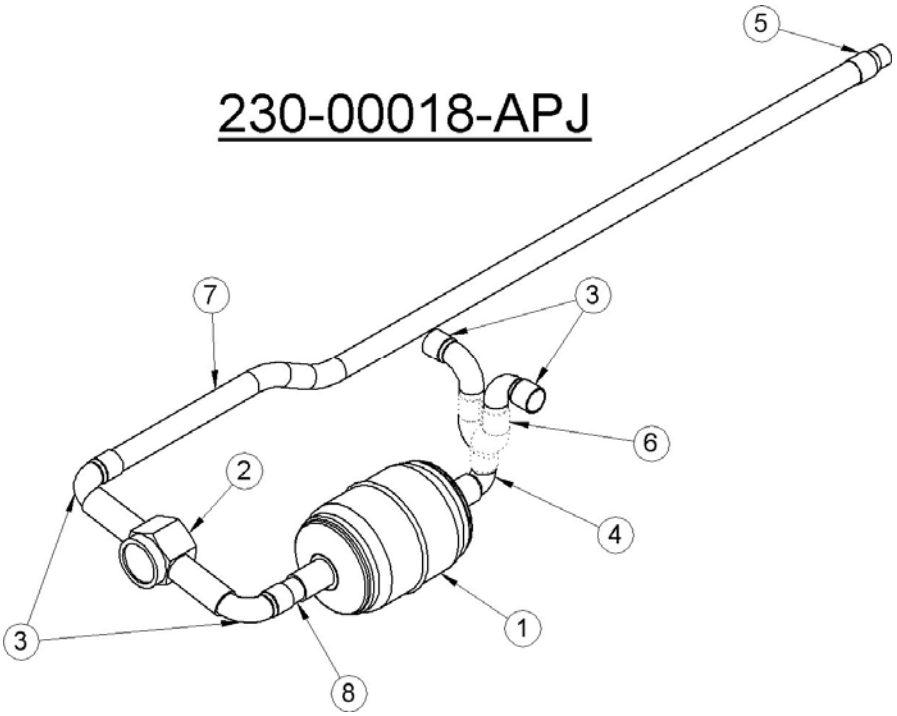
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	023-00023	VALVE-SCHRADER - STEPPED	3
2	031-00032	ELBOW-1-1/8" 90 DEG CxC L.R.	2
3	031-00072	ELBOW-1-1/8" 90 DEG FxC L.R.	1
4	ACR-48K-1	1-1/8" OD X 14-3/4" LONG	1
5	ACR-48K-20	1-1/8" OD X 19-3/4" LONG	1
6	ACR-48K-5	1-1/8" OD X 3-3/8" LONG	1
7	230-00018AO	ASSEMBLY PANEL	1
8	060-00060	GROMMET- 1 1/8 ID, 1/16 WOG	1
9	060-00041	GROMMET- 1/2 ID, 3/32 WOG 3/4 DOG	1
10	060-00008	GROMMET - 5/8	1



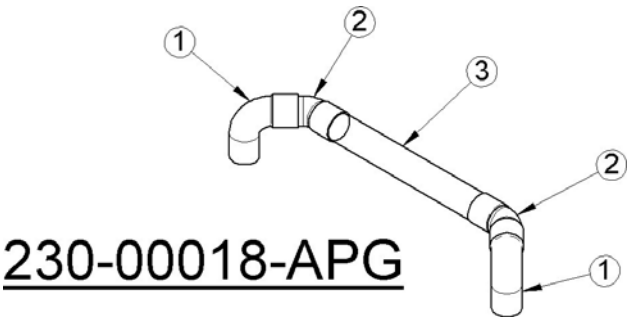
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	023-00023	VALVE-SCHRADER - STEPPED	2
2	031-00017	TEE 7/8	1
3	031-00018	ELL LONG RAD 7/8 FTG TO COPPER	2
4	031-00106	ELBOW - 1/2" 90 DEG FxC L.R.	1
5	031-00124	ELBOW-1/2" 90 DEG FxF L.R.	1
6	031-00139	REDUCER 7/8 X 1/2 FTG TO COPPER	1
7	031-00172	DISTRIBUTOR- CU, 7/8 X 5/8/ X 5/8	1
8	031-00179	ELBOW-7/8" 90 DEG FxF L.R.	1
9	048-00008	VIBRATION ABSORBER 7/8	1
10	048-00009	VIBRATION ABSORBER 1/2	1
11	ACR-48K-13	7/8" OD COPPER	1
12	ACR-48K-6	1/2" OD COPPER	1
13	ACR-48K-8	7/8" OD X 2-1/2" LONG	1



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	023-00007	VALVE-SCHRADER x 3/8ODF (1/4ID)	1
2	023-00023	VALVE-SCHRADER - STEPPED	1
3	023-00034	VALVE-HOT GAS BY-PASS	1
4	023-00036	VALVE-SOLENOID	1
5	023-00039	PRESS RELIEF VALVE	1
6	030-00093	ADAPTOR FEMALE 1/8NPT	1
7	031-00106	ELBOW - 1/2" 90 DEG FxC L.R.	1
8	031-00153	TEE, REDUCING 1/2 X 1/2 X 3/8	1
9	ACR-48K-10	1/2" OD X 2-1/4" LONG	1
10	ACR-48K-11	1/2" OD COPPER	1
11	ACR-48K-9	1/2" OD X 2" LONG	2

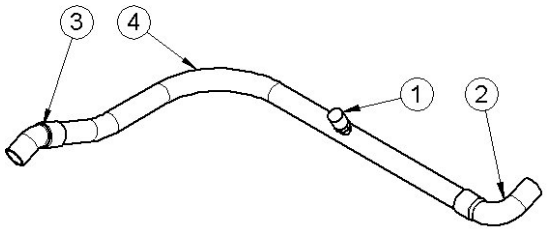


ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	021-00001	FILTER-DRYER	1
2	021-00012	SIGHT GLASS	1
3	031-00015	ELBOW- 5/8" 90 DEG FxC L.R.	4
4	031-00039	STEET ELL SHORT RAD 5/8OD FTG	1
5	031-00041	REDUCER-CxC, 5/8x1/2	1
6	031-00184	DISTRIBUTOR- CU, 5/8 X 5/8/ X 5/8	1
7	ACR-48K-17	5/8" OD COPPER	1
8	ACR-48K-18	5/8" OD X 1-1/2" LONG	1

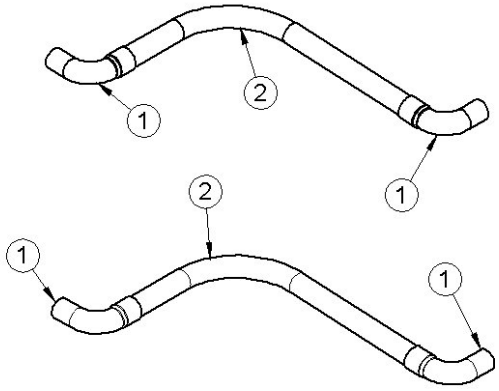


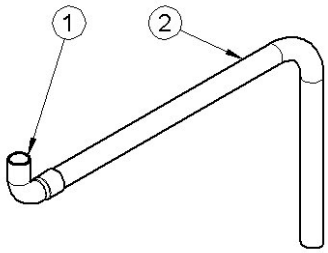
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	031-00009	ELBOW - 1-1/8" 90 DEG FxC S.R.	2
2	031-00083	ELBOW-1-1/8" 45 DEG FxC S.R.	2
3	ACR-48K-4	1-1/8" OD X 10-1/4"	1

230-00018-APF



230-00018-APE



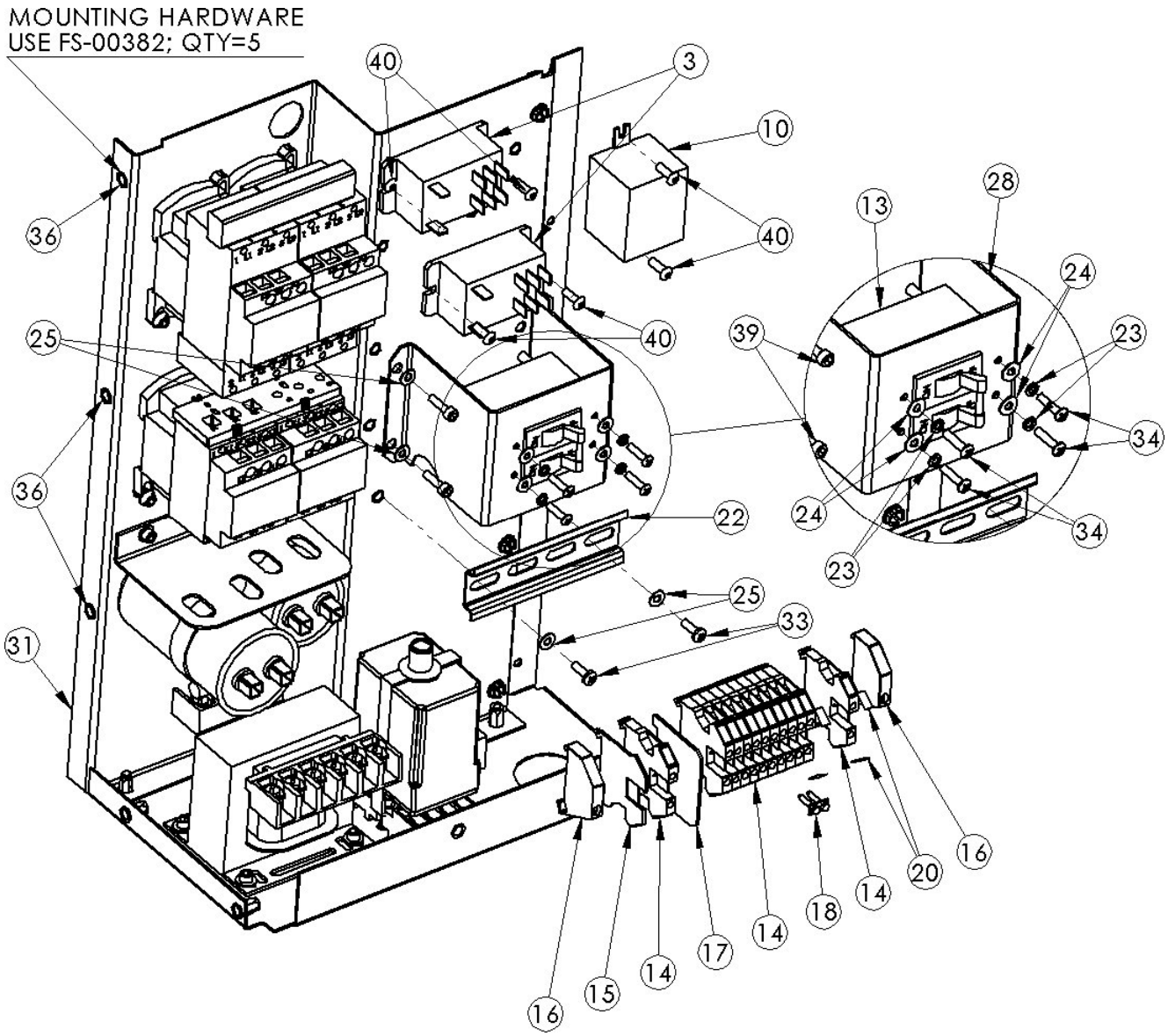


230-00018-APH

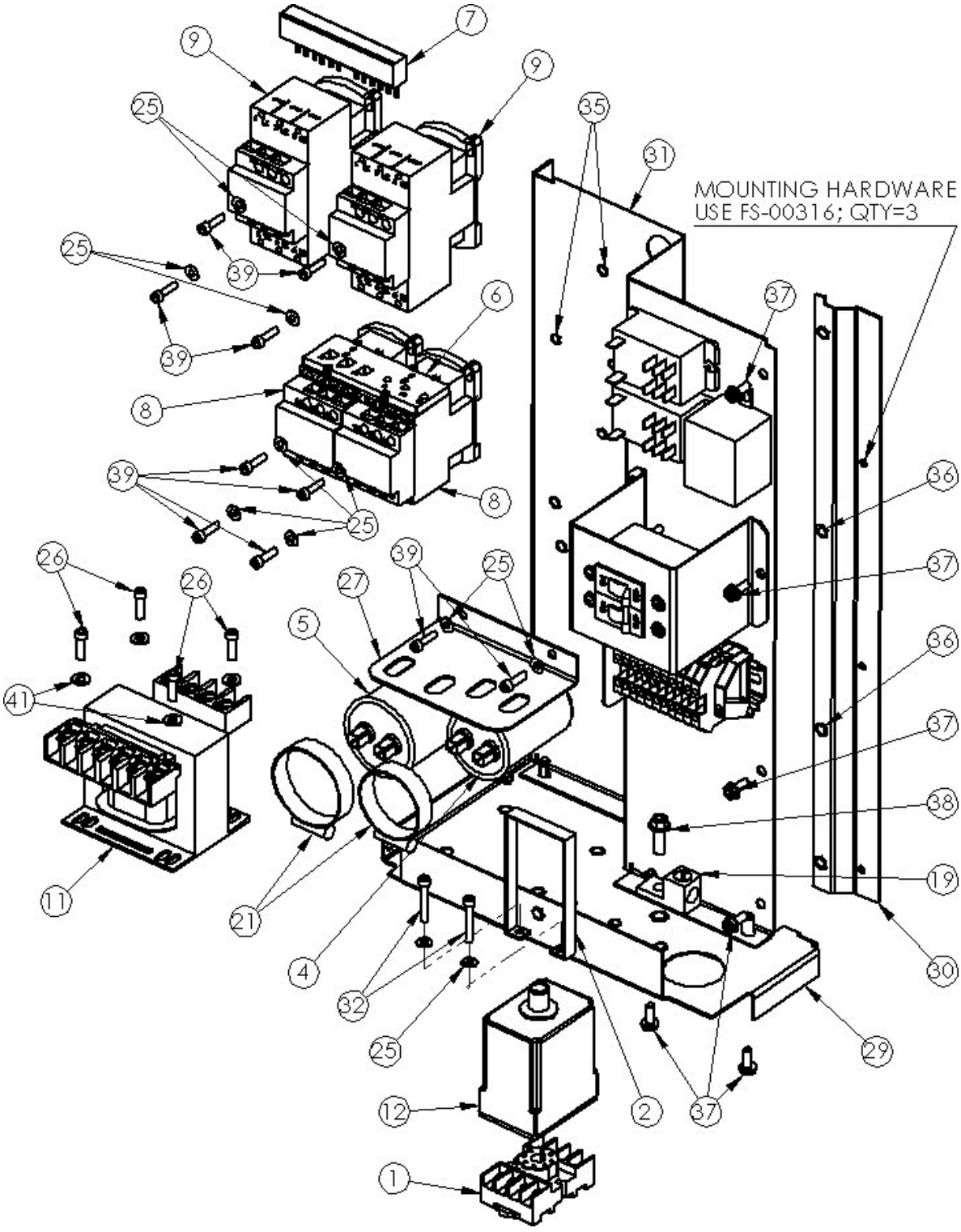
230-00018-APM

230-00018-APF			
ITEM NO.	**PART NUMBER**	**DESCRIPTION**	**QTY.**
1	023-00023	VALVE-SCHRADER - STEPPED	1
2	031-00015	ELBOW- 5/8" 90 DEG FxC L.R.	1
3	031-00120	45 STREET ELL 5/8"OD FTG TO COPPER	1
4	ACR-48K-15	5/8" OD	1
230-00018-APH			
ITEM NO.	**PART NUMBER**	**DESCRIPTION**	**QTY.**
1	031-00015	ELBOW- 5/8" 90 DEG FxC L.R.	1
2	ACR-48K-16	5/8" OD	1
230-00018-APE			
ITEM NO.	**PART NUMBER**	**DESCRIPTION**	**QTY.**
1	031-00015	ELBOW- 5/8" 90 DEG FxC L.R.	2
2	ACR-48K-14-10	1/2" OD COPPER	1
230-00018-APM			
ITEM NO.	**PART NUMBER**	**DESCRIPTION**	**QTY.**
1	031-00015	ELBOW- 5/8" 90 DEG FxC L.R.	2
2	ACR-48K-14-9.25	1/2" OD COPPER	1

230-00018-A4, ELECTRICAL PANEL- MAIN, PAGE 1 OF 3



230-00018-A4, ELECTRICAL PANEL- MAIN, PAGE 2 OF 3

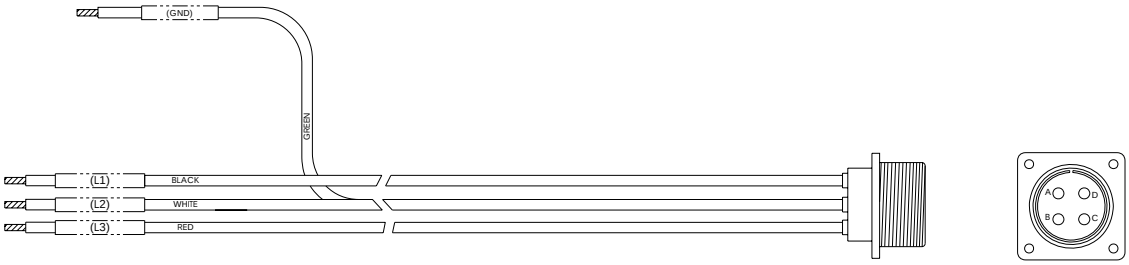


230-00018-A4, ELECTRICAL PANEL- MAIN, PAGE 3 OF 3

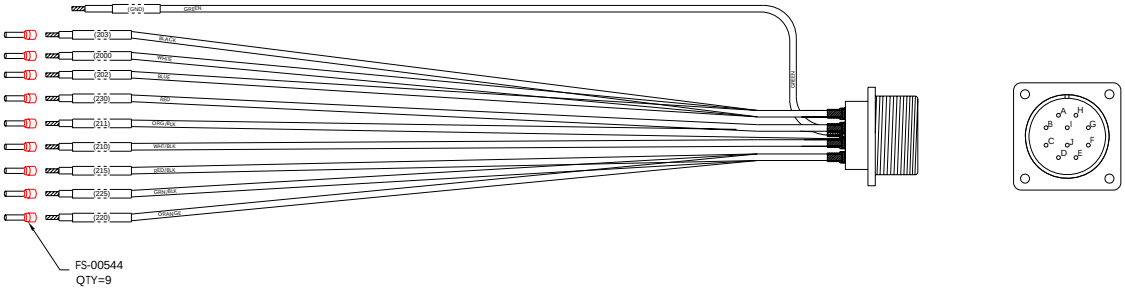
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	013-00028SKT	SOCKET	1
2	013-00182	STRAP-HOLD DOWN	1
3	013-00186	RELAY-SPDT 30AMP	2
4	013-00193	CAPACITOR	1
5	013-00199	CAPACITOR	1
6	013-00209	BUS BAR	1
7	013-00210	BUS BAR	1
8	013-00214	REVERSING CONTACTOR	1
9	013-00245	CONTACTOR-24V	2
10	013-00892	RELAY-DPDT, 24 VAC	1
11	014-00045	TRANSFORMER	1
12	015-00005	PHASE FAILURE RELAY	1
13	016-00339	CIRCUIT BREAKER- 1 AMP, 2 POLE	1
14	017-00015	TERMINAL BLOCK	12
15	017-00016	END COVER PLATE	1
16	017-00017	END BARRIER	2
17	017-00128	PARTITION PLATE	1
18	017-00135	INTERNAL JUMPER ASSY.	1
19	017-00164	LUG-GROUNDING 1/0-14AWG	1
20	018-00050	TAG MARKING	24
21	056-00001	CLAMP-WORM	2
22	069-00001-4	4" DIN RAIL	1
23	1-L-6	LOCKWASHER #6 18-8 STAINLESS	4
24	1-W-6	FLATWASHER #6; 1-W-6	4
25	1-W-8	FLATWASHER #8; 1-W-8	16
26	10-24 X500	SCREW- #10-24 X 1/2" SOCKET CAP	4
27	109-00073	BRACKET-CAPACITOR	1
28	230-00018BJ	MOUNTING PLATE	1
29	230-00018EA	ELECTRIC BOX BASE	1
30	230-00018EB	ELECTRIC BOX STANDOFF	1
31	230-00018EC	ELECTRIC BOX PANEL	1
32	8-32 X 1.000	SCREW- #8-32 X 5/8" SOCKET CAP	2
33	FS-00042	SCREW- #8-32 x 1/2" PHIL	2
34	FS-00222	SCREW- #6-32 x 5/8" PHIL	4
35	FS-00340	RIVNUT-HEX 8-32	22
36	FS-00341	RIVNUT-HEX 10-24	9
37	FS-00382	SCREW- #10-24 x 1/2" SLOT HEX	8
38	FS-00436	1/4-20 X 3/4 HEX WASHER HEAD	1
39	FS-00559	SCREW- #8-32 X 5/8" SOCKET CAP	12
40	FS-00711	SCREW- #8-32 x 1/2" SOCKET BUTTON HD	6
41	FS-00712	FLATWASHER #10; 1-W-10	4

230-00019 POWER CABLE ASS'Y
230-00020 CONTROL CABLE

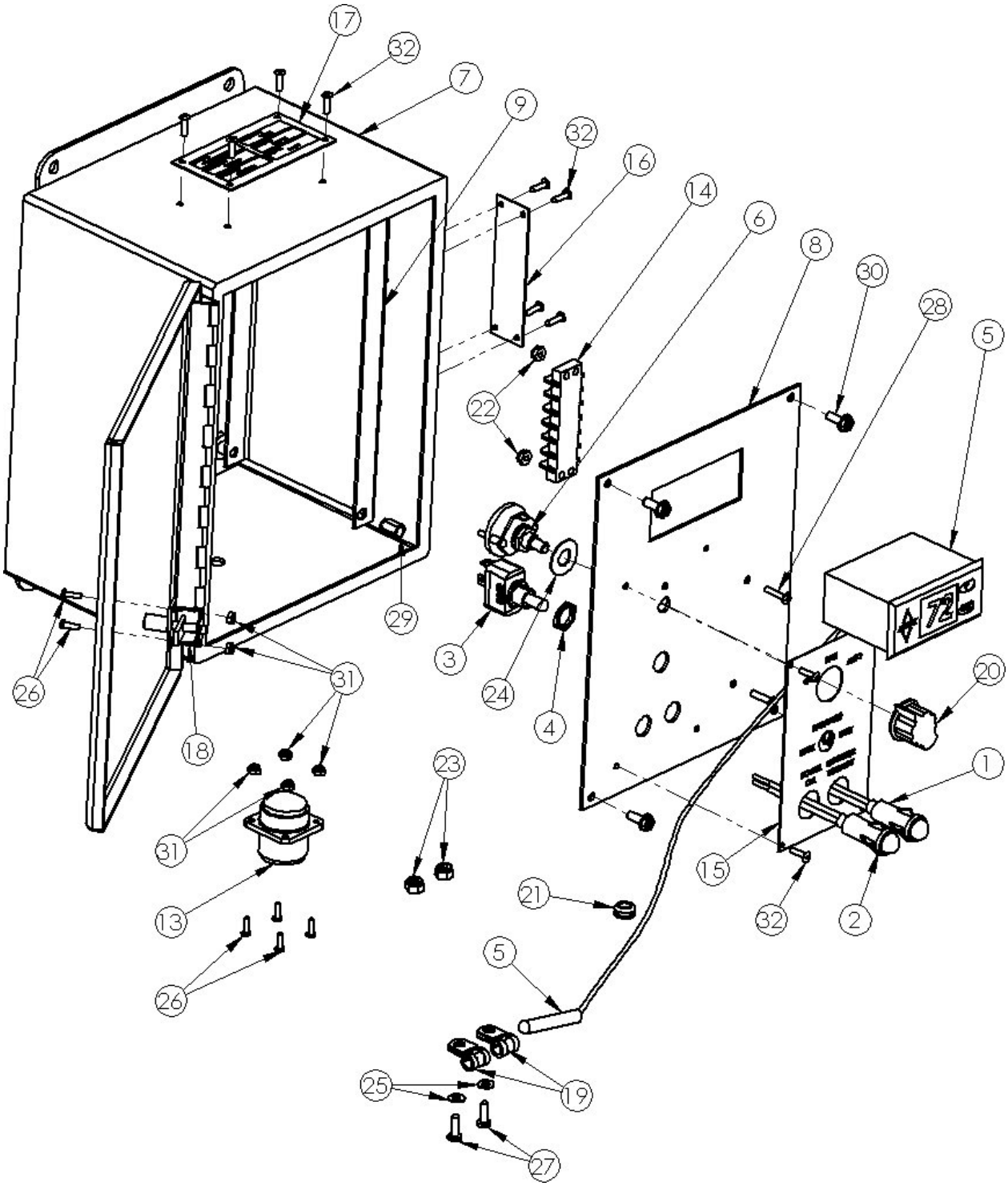
108-00019 POWER CABLE



108-00020 CONTROL CABLE



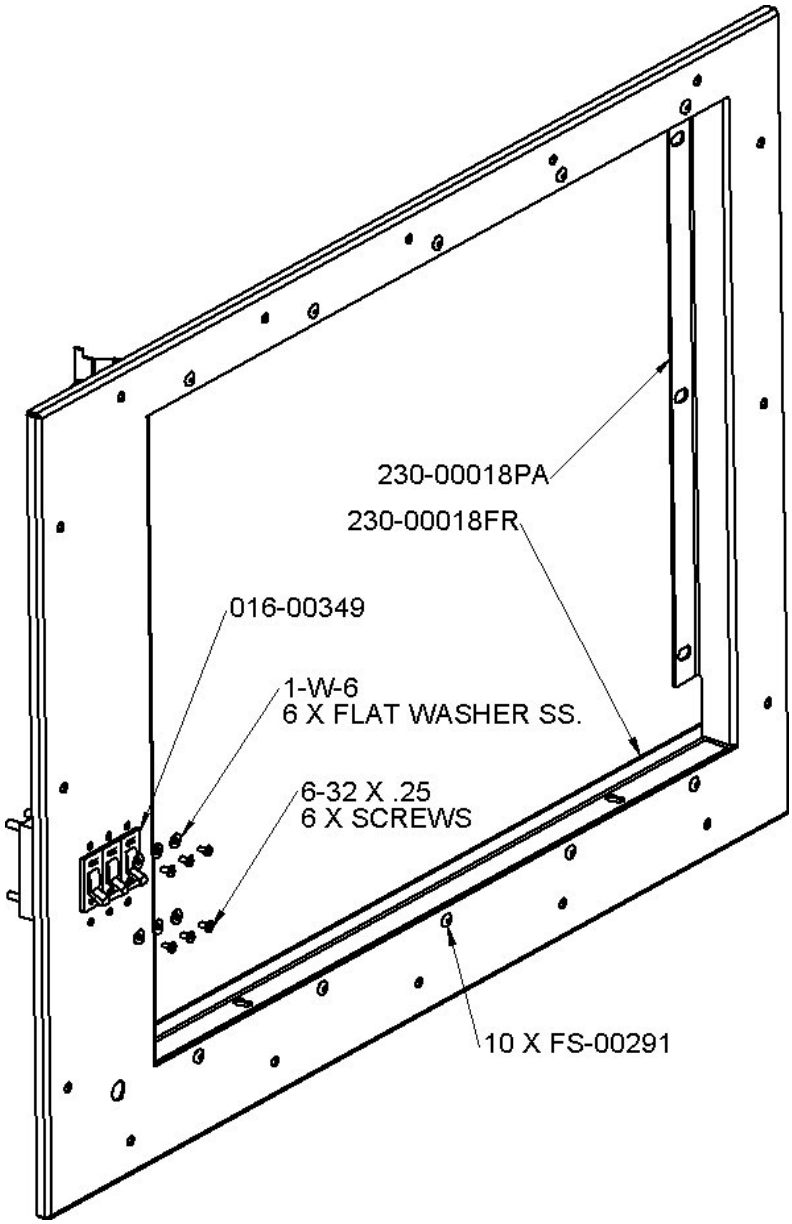
230-00018-A12, REMOTE CONTROLLER ASS'Y, PAGE 1 OF 2



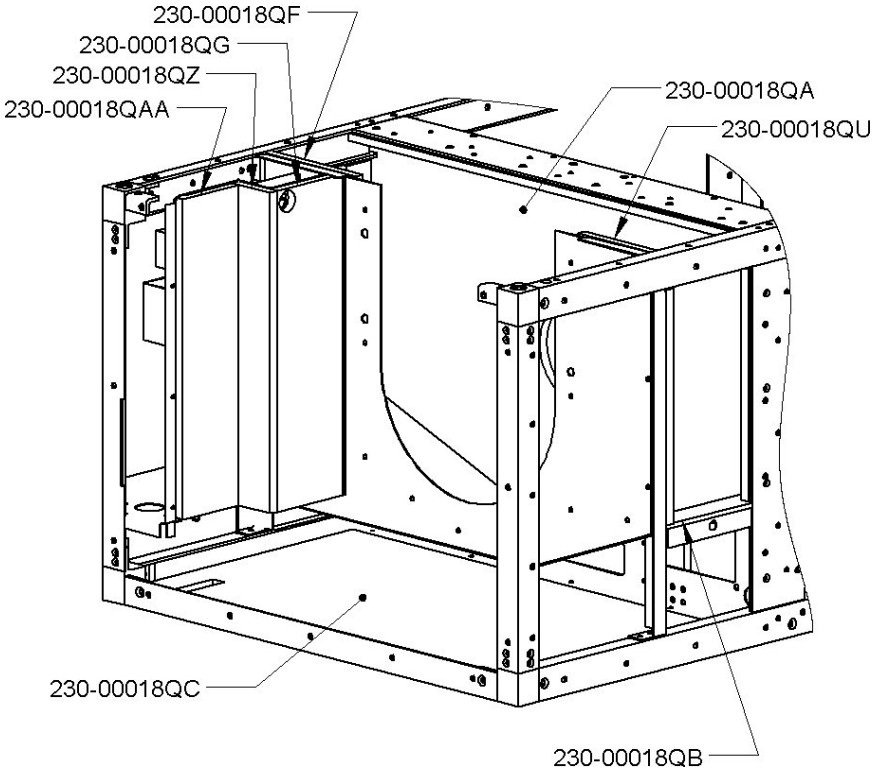
230-00018-A12, REMOTE CONTROLLER ASS'Y, PAGE 2 OF 2

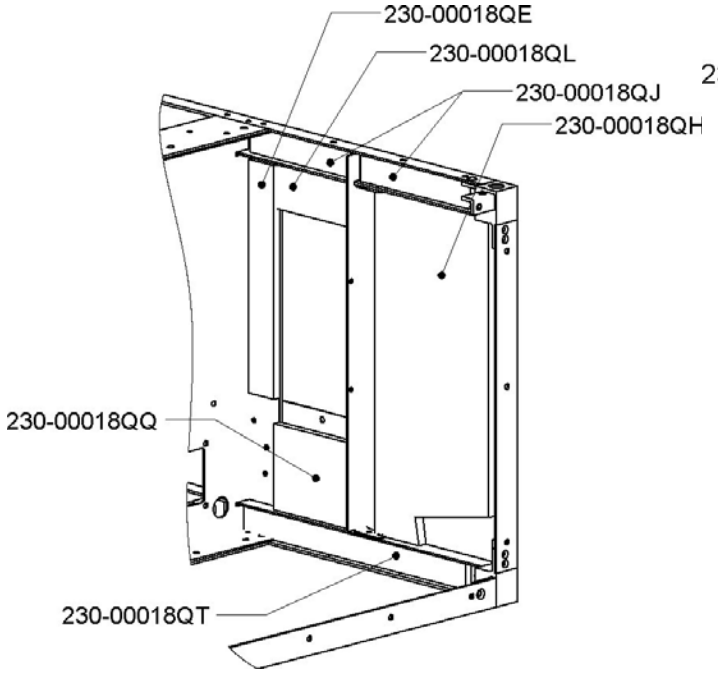
ITEM NO.	PART NUMBER	DESCRIPTION	QTY
1	011-00080	LAMP - RED	1
2	011-00081	LAMP - GREEN	1
3	011-00091	SWITCH - TOGGLE	1
4	011-00091	NUT FOR 011-00091	2
5	011-00110	TEMPERATURE CONTROLLER (INCLUDES SENSE BULB)	1
6	011-00115	SWITCH ROTARY	1
7	012-00065	ENCLOSURE 10 X 8 X 6	1
8	012-00065MP	CONTROL PANEL	1
9	012-00065S	PANEL STANDOFF	2
13	017-00102RM	RECEPTACLE 20-7	1
14	017-00109	TERMINAL BRKT	1
15	018-00259	TAG CONTROL PANEL	1
16	018-00264	48K REMOTE TAG	1
17	018-00265	REMOTE CONTROL ID PLATE	1
18	054-00019	LATCH	1
19	056-00039	LOOP CLAMP 1/4 DIA	2
20	059-00066	CONTROL KNOB	1
21	060-00063	GROMMET- 0.25 ID, 0.125 WOG	1
22	1-N-6C	NYLOCK NUT, SS, 6-32	2
23	1-N-8C	NYLOCK NUT, SS, 8-32	2
24	1-W-37	FLATWASHER- 3/8" SS	1
25	1-W-8	FLATWASHER #8; 1-W-8	2
26	4-40 x 375	SCREW- #4-40 x 3/8" PHIL	6
27	FS-00042	SCREW- #8-32 x 1/2" PHIL	2
28	FS-00222	SCREW- #6-32 x 5/8" PHIL	2
29	FS-00341	RIVNUT-HEX 10-24	4
30	FS-00382	SCREW- #10-24 x 1/2" SLOT HEX	4
31	FS-00415	NYLOCK NUT, SS, 4-40	6
32	FS-00429	RIVET-POP, 1/8" SS	12

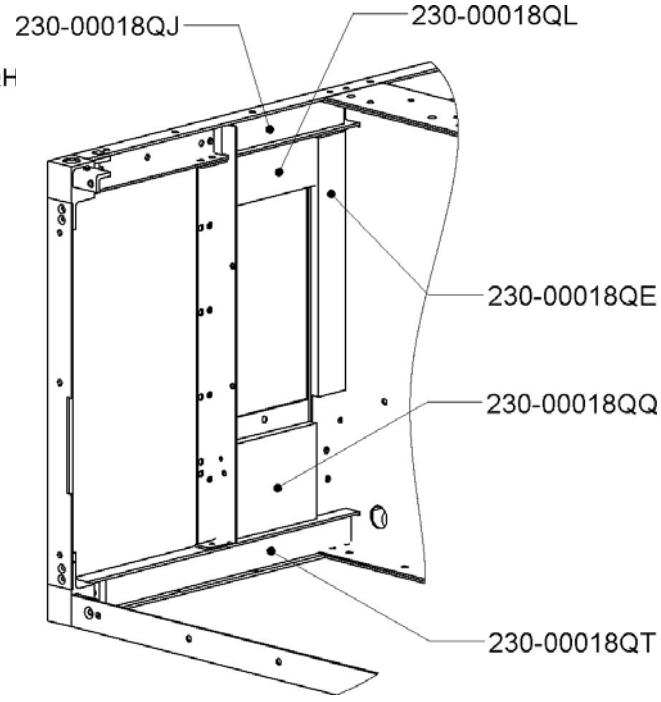
230-00018-AM, 40A, CIRCUIT BREAKER ASS'Y



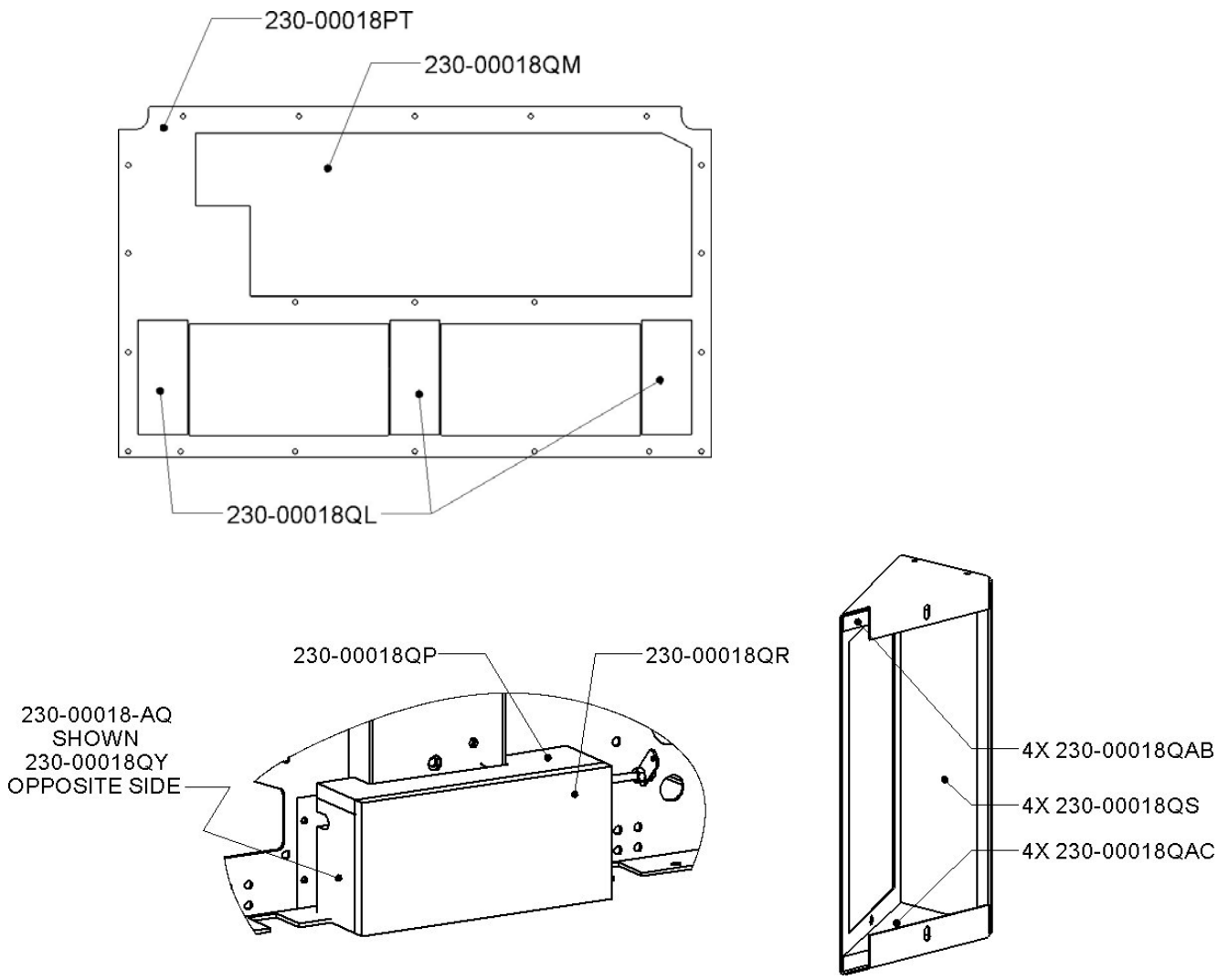
230-00018-AM, INSULATION PARTS, PAGE 1 OF 2





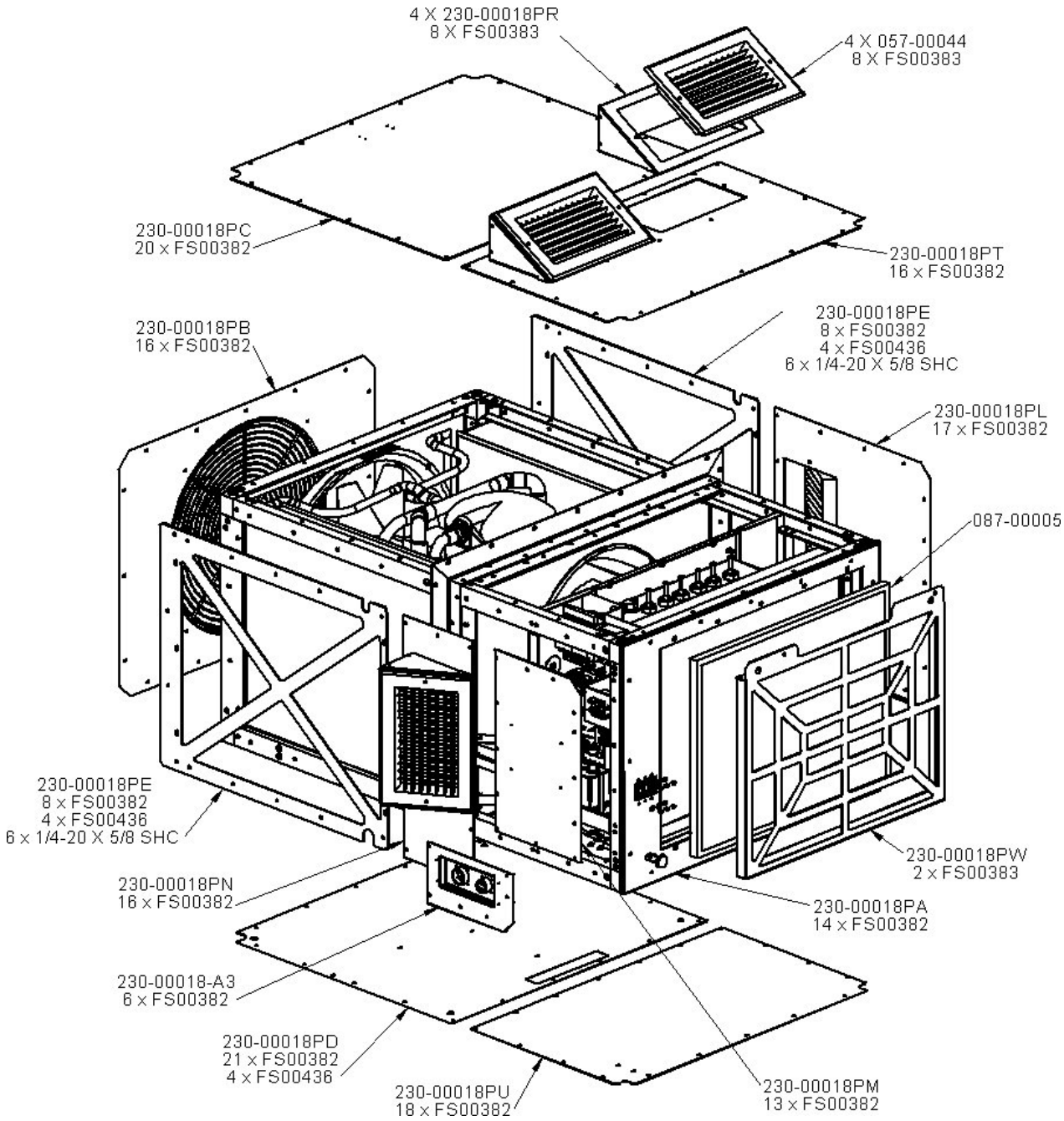


230-00018-AM, INSULATION PARTS, PAGE 2 OF 2



NOTES:
MATERIAL: AP ARMAFLEX, CLOSED CELL, OR EQUIVALENT,
1/2” THICKNESS FOR ALL PIECES, EXCEPT 230-00018QB, 1/4" THICKNESS.
ADHESIVE (PSA): MACbond IB 6280/6205 OR EQUIVALENT, WITH BLUE HDPE LINER ONE SIDE
HEAT SHIELD INCLUDED ON 230-00018QG AND 230-00018QM PARTS
ALUMINUM LAMINATE W/ADHESIVE BACKING, "VENTURE CLAD" 1577CW WITH PSTC
ADHESIVE BACKING OR EQUIVALENT,
5 PLY LAMINATE, 3 MILS THICK.

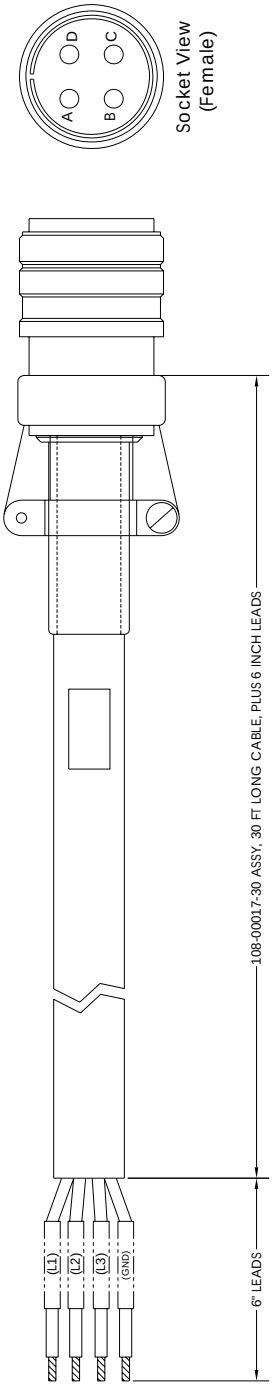
230-00018-AM, OUTER SKINS PARTS. PAGE 1 OF 2



230-00018-AM, OUTER SKINS PARTS. PAGE 2 OF 2

PART NUMBER	DESCRIPTION	QTY
057-00044	GRILLE- 10" X 6"	4
087-00005	FILTER-METAL 18x23x1	1
230-00018-A3	CONNECTION ASSEMBLY	1
230-00018PA	FRONT PANEL	1
230-00018PB	CONDENSER END COVER	1
230-00018PC	CONDENSER TOP PLATE	1
230-00018PD	CONDENSER BOTTOM COVER	1
230-00018PE	CONDENSER GRILLE	2
230-00018PL	EVAPORATOR RIGHT COVER	1
230-00018PM	EVAP LEFT FRONT COVER	1
230-00018PN	EVAP SIDE COVER	1
230-00018PR	SIDE REGISTER MOUNT	4
230-00018PT	EVAORATOR TOP COVER	1
230-00018PU	EVAPORATOR BOTTOM COVER	1
230-00018PW	FILTER GRILLE	1
FS00382	SCREW- #10-24 X 1/2" SLOTTED HEX	173
FS00383	SCREW- #10-24 X 3/4" SLOTTED HEX	18
FS00436	SCREW-1/4-20 X 3/4 SLOTTED HEX	12
1S-25C-62	SCREW-1/4-20 X 5/8 SHCS SS	12

108-00017-30, TEST CABLE.



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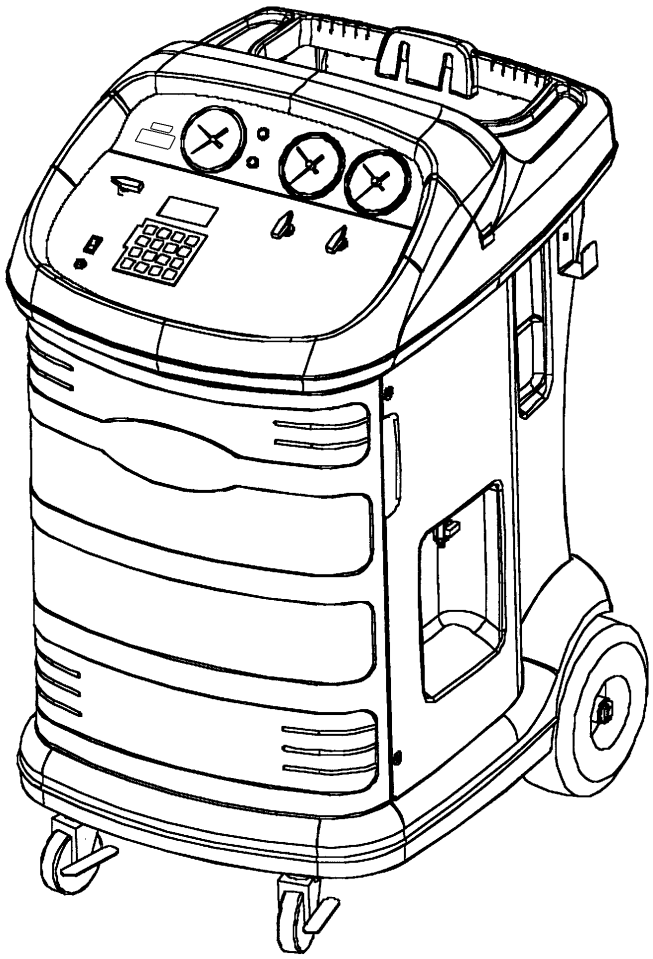
CHAPTER 11

ROBINAIR RECOVERY SYSTEM MANUAL

P/N 17800B NSN 4330-01-411-7240

SPX ROBINAIR

Operating Manual
Manual de Operación
Manuel d'utilisation



Model 17800B/17801B

Modelo 17800B/17801B

Modèl 17800B/17801B

SPX ROBINAIR

Refrigerant Recovery, Recycling, and Recharging Station

Design Certified by Underwriters Laboratories Inc.® to meet SAE-J-1770 for recycling R-134a and R-12 using common refrigeration circuits.

LISTED 80S2

Model / Volts / Amps: 17800B / 115V 60 Hz / 12.0; 17801B / 230V 50 Hz / 7.0
Refrigerants: R-12, R-134a, ARI 98 Class III, and ARI 98 Class IV
Design Pressure: High 382 psig Serial No.:
Low 171 psig Date Code:

SAFETY DEFINITIONS: Follow all **WARNING**, **CAUTION**, **IMPORTANT**, and **NOTE** messages in this manual. These messages are defined as follows: **WARNING** means you may risk serious personal injury or death; **CAUTION** means you may risk personal injury, property damage, or serious unit damage; **IMPORTANT** means you may risk unit damage; and **NOTEs** provide clarity and helpful tips. These safety messages cover situations ROBINAIR is aware of. ROBINAIR cannot know, evaluate, and advise you as to all possible hazards. You must make sure all conditions and procedures do not jeopardize your personal safety.

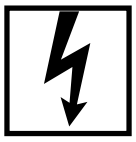
DISCLAIMER: All information, illustrations, and specifications contained in this manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without obligation to notify any person or organization of such revisions or changes. Further, ROBINAIR shall not be liable for errors contained herein or for incidental or consequential damages (including lost profits) in connection with the furnishing, performance, or use of this material. If necessary, obtain additional health and safety information from the appropriate government agencies and the vehicle, refrigerant, and lubricant manufacturers.

⚠ WARNING ⚠

CAUTION: RISK OF INJURY. ALLOW ONLY QUALIFIED PERSONNEL TO OPERATE THE UNIT. Before operating the unit, the operator must be able to read and follow the instructions and warnings in this manual. The operator must be a certified technician and must be familiar with air conditioning and refrigeration systems, refrigerants, and the dangers of pressurized components.

PRESSURIZED TANK CONTAINS LIQUID REFRIGERANT. OVERFILLING THE TANK MAY CAUSE VIOLENT EXPLOSION AND POSSIBLE INJURY OR DEATH. Safety devices require the use of only authorized refillable refrigerant tanks. This includes Robinair Part Nos. 17506 and 34750 (50 lb.) tank. Do not recover refrigerants into a non-refillable storage container! Federal regulations require refrigerant to be transported only in containers meeting DOT spec. 4BW or DOT spec. 4BA.

ALL HOSES MAY CONTAIN LIQUID REFRIGERANT UNDER PRESSURE. Contact with refrigerant may cause injury. Wear correct protective equipment, including safety goggles. Use extreme caution when disconnecting hoses.



HIGH VOLTAGE ELECTRICITY INSIDE PANELS. RISK OF ELECTRICAL SHOCK. Disconnect power before servicing unit. Refer to the operating manual.

TO REDUCE THE RISK OF FIRE, avoid the use of an extension cord because an extension cord may overheat. However, if you must use an extension cord, the cord must be No. 14 AWG minimum, and keep the cord as short as possible. Do not use this equipment in the vicinity of spilled or open containers of gasoline, or other flammable substances.

Use this equipment in locations with mechanical ventilation that provides at least four air changes per hour, or locate the equipment at least 18 inches off the floor.

Verify all safety devices are functioning correctly before operating the unit. Before operating, read and follow the instructions and warnings in the operating manual.

Use this unit with R-12, R-134a, and ARI 98 Refrigerant Classes III and IV systems only. This unit is not designed for any other purpose than recovering or recycling refrigerants! Do not mix refrigerant types!

Additional health and safety information may be obtained from refrigerant and lubricant manufacturers.

This equipment is protected by one or more of the following U.S. and foreign patents.

U.S. Patents: 4,523,897; 4,688,388 Re 33,212; 4,768,347; 4,805,416; 4,878,356; 4,938,031; 5,005,369; 5,005,375; 5,038,578; 5,042,271; 5,063,749; 5,095,713; 5,181,391; 5,203,177; 5,231,842; 5,248,125, 5,493,869; 5,603, 223.

Foreign Patents: AUS 609,240; 613,058; 622,833; 633,766. BRAZ PI 8803612. CAN 616,474; 1,311,621; 1,311,622; 1,331,922; 2,012,620; 2,026,348. EUR 0 315 296 B1; 0 329 321 B1; 0 437 021 B1. MEX 16208. SAF 88/4981.

Other U.S. and Foreign Patents Pending.

Manufactured by Robinair, SPX Corporation, Owatonna, MN 55060. PRINTED IN USA.

This manual contains important safety procedures concerning the operation, use, and maintenance of this product. Failure to follow the instructions contained in this manual may result in serious injury. If you are unable to understand any of the contents of this manual, bring it to the attention of your supervisor. Do not operate this equipment unless you have read and understood the contents of this manual.

TABLE OF CONTENTS

See the Index on page 48 for a listing of all procedures and diagrams.

Introduction

The 17800B/17801B is a complete A/C-R service center. It recovers, recycles, and recharges a wide range of refrigerants — from existing refrigerants to new substitutes and blends. With its multi-refrigerant capabilities, it is ideal for trucks, buses, and refrigerated trailers, as well as in-plant maintenance and other accessible installations.

The built-in manifold means the entire service procedure can be done with just one hook-up. A microprocessor controls the unit's functions; evacuation time and the amount of refrigerant to be recharged can be programmed at the beginning of the job. Prompts lead you through programming and alert you when the filter and vacuum pump oil need to be changed.

This unit is UL-listed and meets the SAE specifications for recycled refrigerant. It is also designed to be compatible with existing service equipment and standard service procedures.

This unit is simple to operate and has many user-friendly features:

- a built-in 6 cfm vacuum pump for quick, yet thorough, evacuation.
- a plastic enclosure for safe and easy manuevering around vehicles without the worry of scratches.
- an electronic scale that weighs recovered refrigerant and recharges by weight for greatest accuracy.
- a pressure/temperature chart mounted directly above the gauges — with just a quick glance you can tell the temperatures in the system.
- large diameter wheels that make it easy to move the unit.

IMPORTANT! To validate your warranty, complete the warranty card attached to your unit, and return it within ten days from date of purchase.

GLOSSARY OF TERMS

A/C-R	Air conditioning or refrigeration
A/C-R System	The air conditioning or refrigeration system serviced
Unit	The refrigerant recovery, recycling, recharging unit
Tank	The refillable refrigerant tank

GENERAL OPERATING GUIDELINES

- The voltage at the unit must be ±10% of the unit's rated voltage. Extension cords must be a minimum of 14 AWG and kept as short as possible.
- To interrupt any procedure (other than clearing), press **HOLD/CONT**. Press **HOLD/CONT** again to resume operation.
- System oil should be drained at the end of every recovery or recycling procedure, during the clearing process, or whenever oil is visible in the sight glass.
- The indicator light will tell you the state of the refrigerant coming into the unit during recovery: **ON** is liquid, **OFF** is vapor. The light is not used for recycling, since the refrigerant coming from the tank will always be a liquid.
- Some tanks have slightly different valve configurations. Connect the red hose to the GAS (vapor) valve; connect the blue hose to the LIQUID valve.
- To ensure scale readings are as accurate as possible, before each procedure, verify the tank is not touching the sides of the cart.
- To minimize mixing of refrigerants, follow the steps in *Changing Refrigerant Types* when switching between refrigerant types.
- When the unit is first turned on, the display shows either:
  "134a" (indicates R-134a automotive refrigerant using 1/2" Acme fittings);
  "R12" (indicates all other refrigerant types using 1/4" flare fittings); or
  "DOOR" (indicates the unit has been cleared).

  Select R-12 or R-134a, and verify you have selected the correct refrigerant type.
- Use the correct hose set for the refrigerant type selected:

Hose Set	Tank Hoses (3)	System Hoses (2)
R-134a automotive	36", 1/2" Acme with double Quick Seal	96", one Quick Seal with one quick coupler
R-12 automotive	36", 1/4" flare with double Quick Seal	96", 1/4" flare with double Quick Seal
All other refrigerant types	36", 1/4" flare with single Quick Seal	96", 1/4" flare with ball valve

Before you begin any procedure, familiarize yourself with the components of the unit.

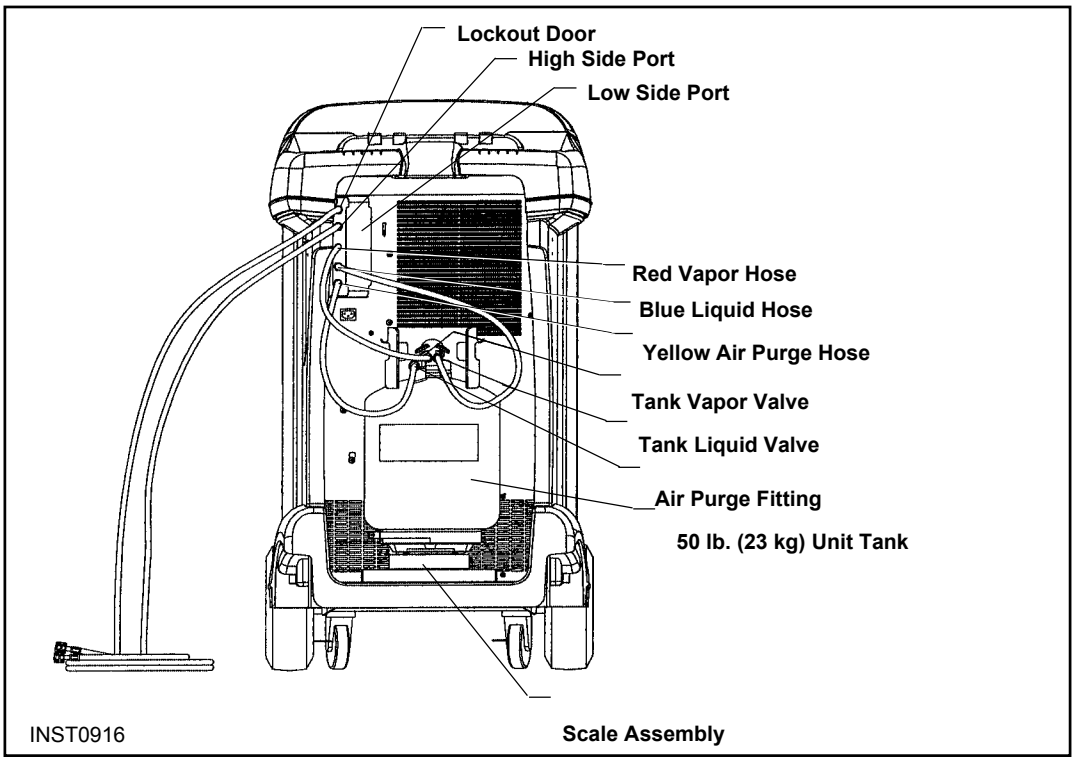


Diagram of Unit's Components — External View

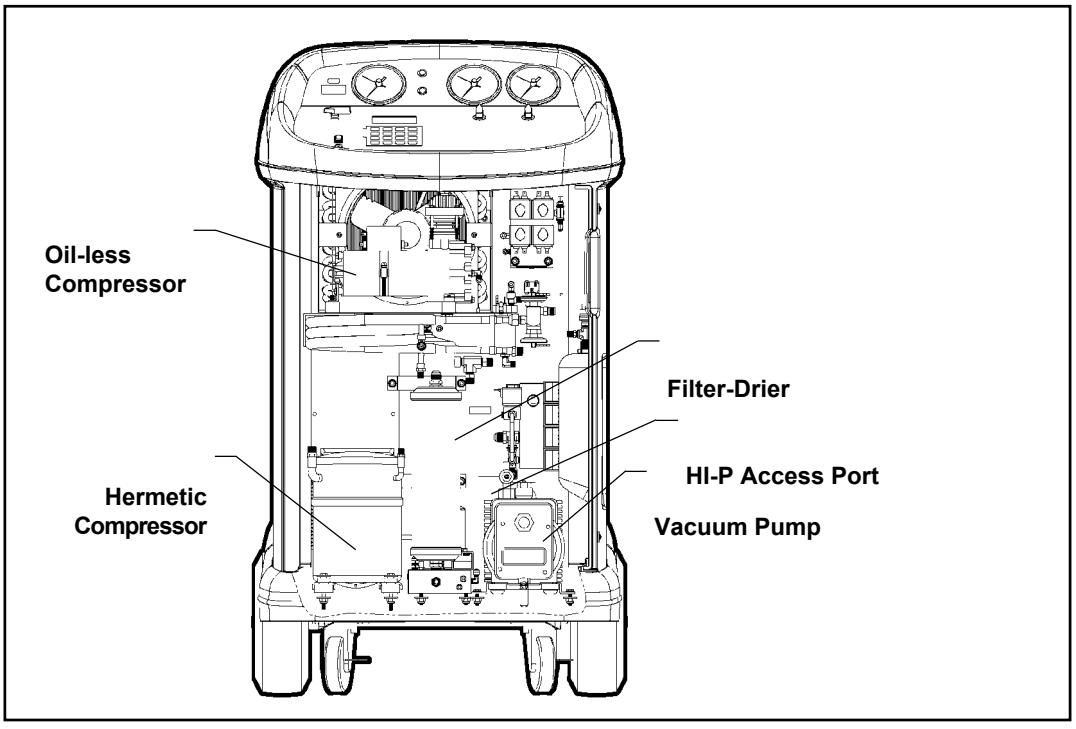


Diagram of Unit's Components — Internal View

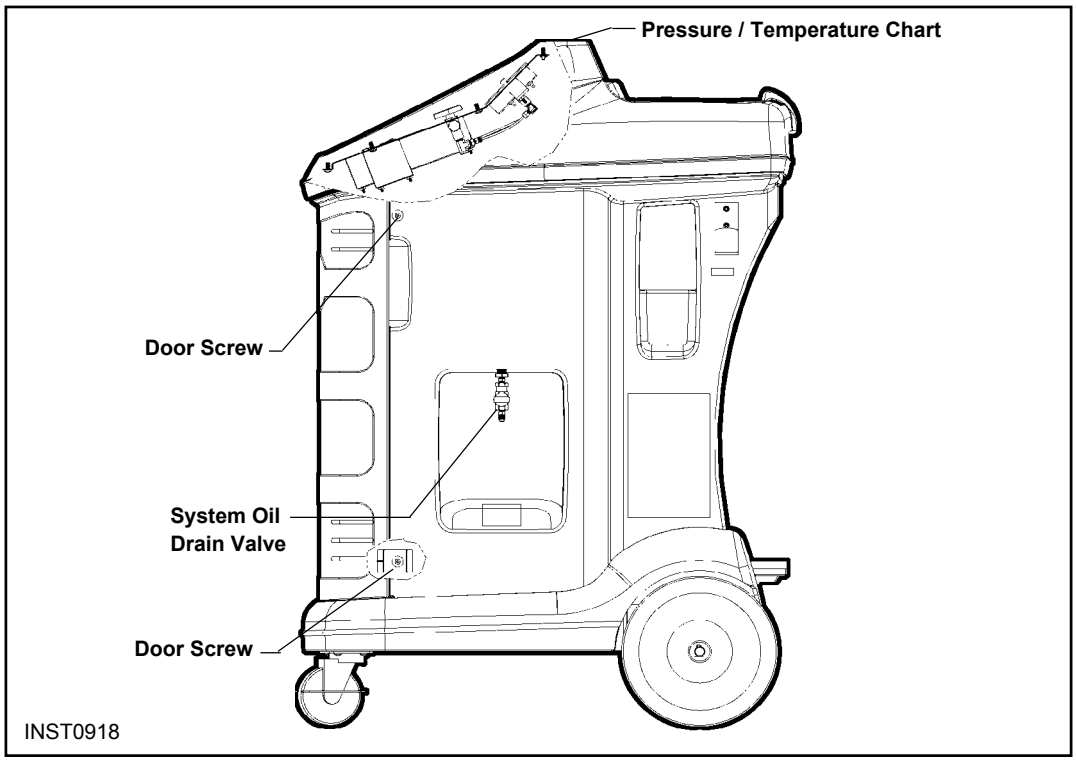


Diagram of Unit's Components — Side View

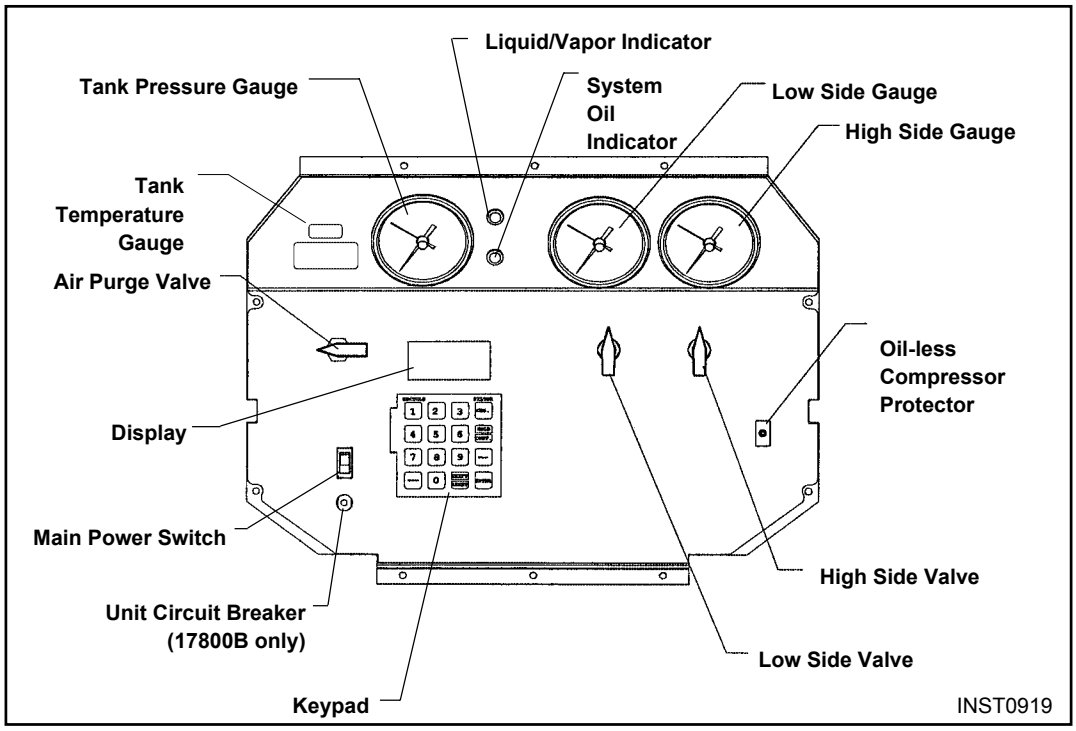


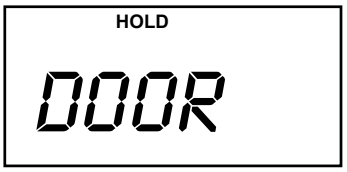
Diagram of Control Panel and Keypad

Before starting the set up procedures, open the system oil drain valve and allow the unit to depressurize.

1. Plug the unit into a correct voltage outlet.

CAUTION! Avoid the use of an extension cord because the extension cord may overheat. However, if you must use an extension cord, use a No. 14 AWG minimum and keep the cord length to 25 feet (7.6 meters) or less.

2. Verify the oil drain valve on the side of the unit is in the **CLOSED** position.



3. Turn on the unit. The display flashes "door." Slide the lockout door (in the upper left corner of the back of the unit) to expose the 1/4" flare fittings for R-12, or the 1/2" Acme fittings for R-134a. Then press **SHIFT/RESET** to continue.

4. Connect either of the automotive hose sets as follows:

- Connect the 36" red hose to the **RED** fitting on the back of the unit.
- Connect the 36" blue hose to the **BLUE** fitting on the back of the unit.
- Connect the 36" yellow hose to the **YELLOW** fitting on the back of the unit.

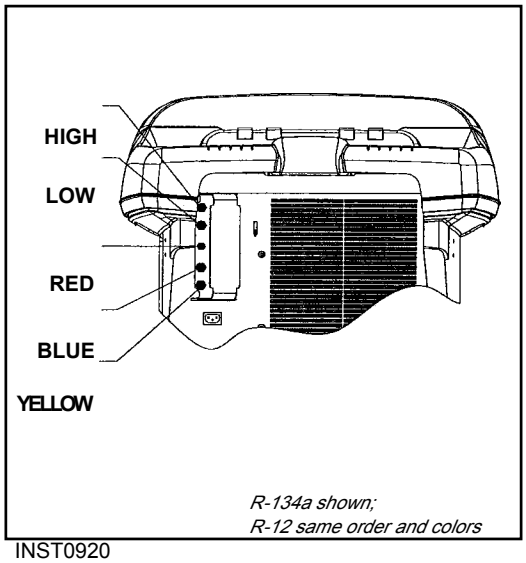


Diagram of Hose Connections — Lockout Box

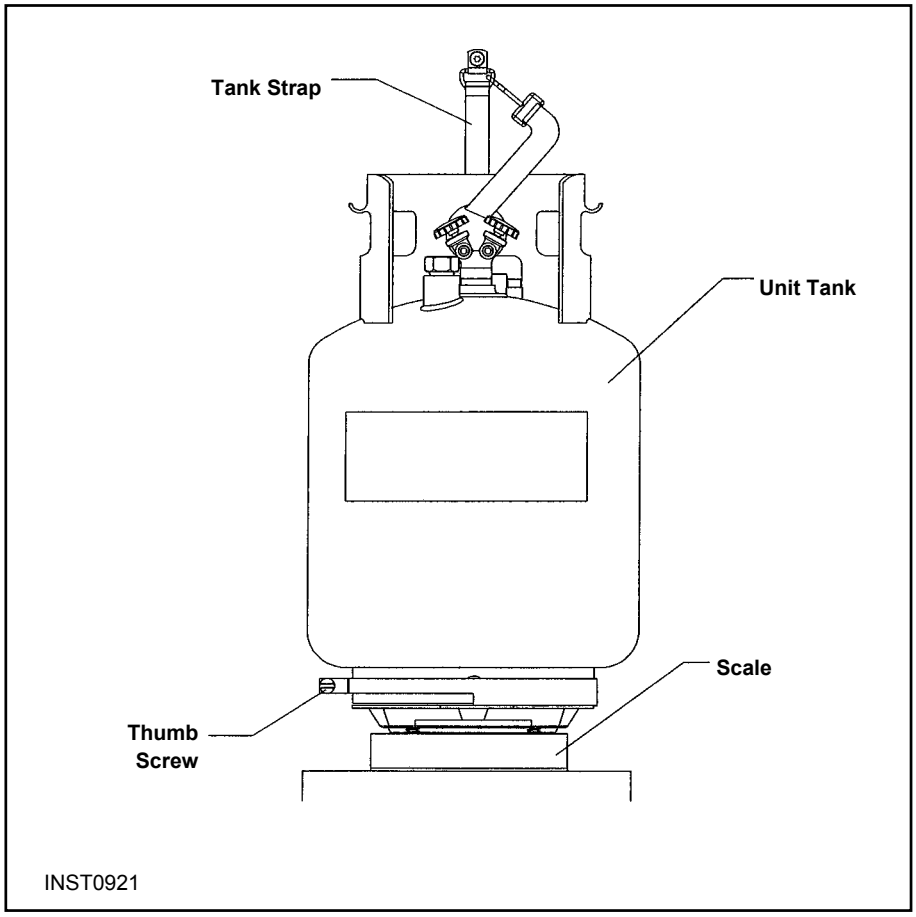
CAUTION! R-134a automotive systems have 1/2" Acme fittings (per SAE specifications) to avoid cross-contamination with systems using 1/4" flare fittings. Do not attempt to adapt your unit for the other refrigerant — system failure will result!

5. A new tank comes with a dry nitrogen charge of 5 to 10 psi to keep it clean and dry during shipment. Purge the nitrogen charge on the R-12 (gray and yellow) tank by opening the **GAS** (vapor) valve on the tank. Vent the pressure to the atmosphere; then close the valve.

6. Place the unit tank inside the ring on the scale platform on the back of the unit. Loop the tank strap through the tank collar, and secure the latch end of the strap to the metal loop at the other end of the strap. Use the thumb screw on the scale ring to tighten the tank to the scale platform.

7. Connect the 36" red hose to the red valve on the tank, and open the valve. Connect the 36" blue hose to the blue valve on the tank, and open the valve. Connect the 36" yellow hose to the air purge fitting on the tank.

8. Open both the low- and high-side valves on the control panel.



Placing the Tank on the Scale

The VacuMaster® vacuum pump is shipped without oil in the reservoir. Before starting the unit, fill the pump with oil. Two 16-ounce (472 milliliters) bottles of oil are included with your unit.

9. Remove the door access screws from the right side of the unit. Open the door.
10. Remove the black plastic plug from the pump's oil fill port. Attach the flexible spout and cap to the bottle of oil included with your unit. This makes it easier to fill the pump.
11. Add one-half of a bottle of vacuum pump oil to the vacuum pump.
12. Press **SHIFT/RESET** and **ENTER** at the same time; then press "1." The vacuum pump will start and run continuously. While the pump is running, pour oil into the pump's oil fill port until the level of oil is even with the line of the pump reservoir sight glass. Replace the black plug on the oil fill port.
13. Let the pump run for about five (5) minutes to remove any air from the unit.
14. To turn off the pump, press **HOLD/CONT**. Then press **SHIFT/RESET** to exit the diagnostics mode.
15. Connect the blue 96" hose to the low side port, and the red 96" hose to the high side port on the back of the unit.

Important!
The pump must be running when adding oil. Do not overfill the pump. The approximate oil charge is 13 oz. (384 milliliters).

Before using a new tank, you must purge its nitrogen charge and pull it into a vacuum.

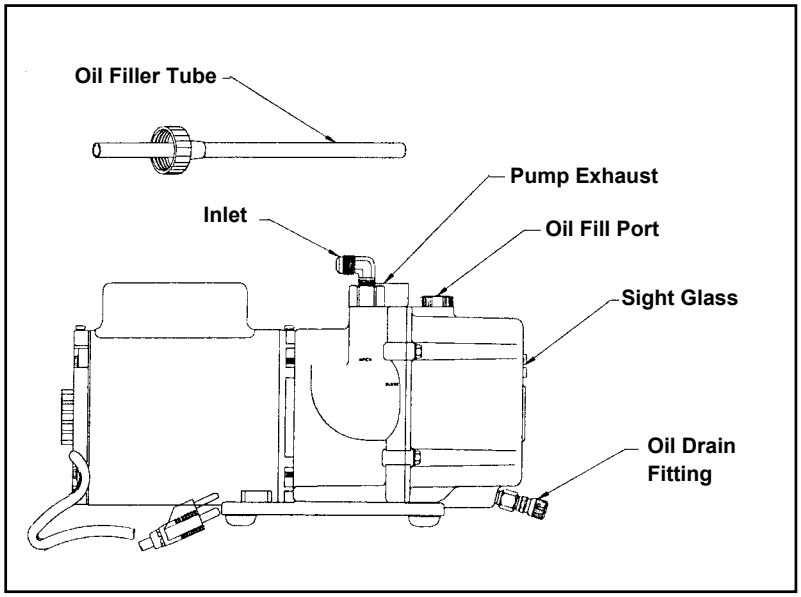


Diagram of Vacuum Pump Components

The 50 lb (23kg) unit tank must be filled with refrigerant before the unit is ready for use.

TANK FILL

1. Connect the 96" blue low-side hose to the liquid valve fitting on the source tank. If using R-134a, you may need the 1/2" acme to low-side adapter included in the accessory kit.

   Note: *Some tanks have slightly different valve configurations. Be sure to connect the blue hose to the LIQUID valve. This valve may be red on some tanks and blue on others.*

2. Press **SHIFT/RESET** and **ENTER** at the same time; then press 2. The unit will begin transfering refrigerant from the source tank to the unit tank.

3. The unit will fill the recovery tank with up to 30 lbs of refrigerant and automatically stop. The display will flash "CPL" when the process is complete.

4. To discontinue tank fill at any time, press **HOLD/CONT**.

CAUTION: To prevent personal injury,

- **Wear safety goggles when working with refrigerant.**
- **Use only authorized refillable refrigerant tanks.**
- **Disconnect hoses using extreme caution!**
- **All hoses may contain refrigerant under pressure.**
- **Read and follow all warnings at the beginning of this manual before operating the unit.**

RECOVERY PROCEDURES

WARNING!

Wear safety goggles when working with refrigerant. Use only authorized refillable refrigerant tanks. Disconnect hoses using extreme caution!

All hoses may contain refrigerant under pressure. Read and follow all warnings at the beginning of this manual before operating the unit.

Before beginning recovery, verify the unit is set up as described in the *Setup Instructions*. Also verify there is vacuum pump oil in the vacuum pump.

1. Connect the high- and low-side hoses to the A/C-R system, as you would normally connect your manifold gauge set.

2. Verify both the high- and low-side valves on the control panel are open. Also verify both valves on the tank are open.

3. Plug the unit into a correct voltage outlet, and turn on the **MAIN POWER** switch. The display shows either "134a" (which indicates R-134a automotive refrigerant that uses $^1/_2$" Acme fittings) or "R12" (which indicates all other refrigerant types that use $^1/_4$" flare fittings). The display may flash "door," which indicates the unit is cleared and can be set up for any refrigerant type.

4. Press **RECOVER**.

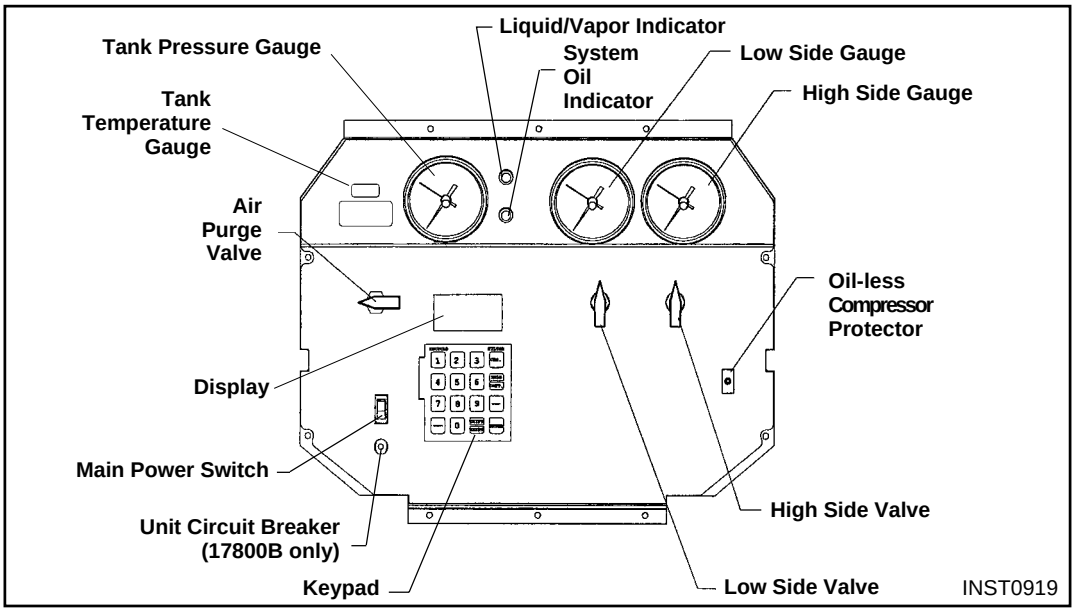
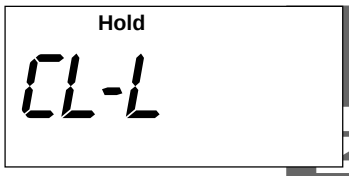
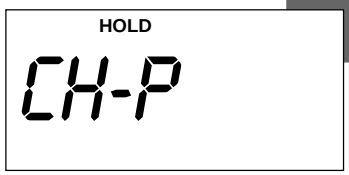


Diagram of Control Panel

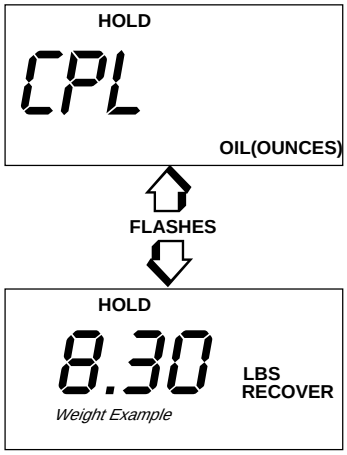
The "CL-L" message shows on the display if there is pressure in the unit, and a self-clearing process of the components begins. You can press **HOLD/CONT** to bypass clearing if an accurate recovery amount is not required. Otherwise, the compressor will start and the "CL-L" message remains on the display. This process takes from 20 seconds to four minutes to complete. Once the clearing is complete, the unit automatically begins to recover refrigerant from the system. If there is no internal pressure in the unit, refrigerant recovery begins immediately.



CAUTION! If the A/C system pressure is 25 psi or less, the message "CH-P" appears on the display to alert you not to attempt recovery from an empty system. Do not press HOLD/CONT to continue the recovery process unless you know the A/C system contains refrigerant.



The display shows that the unit is in the RECOVER mode and the AUTOMATIC cycle. You can monitor the amount of refrigerant removed from the system by watching the display. The compressor shuts off automatically when recovery is complete (at approximately 13 inches of vacuum). The display shows the "CPL" message, and then alternately flashes the weight of refrigerant recovered.



5. To assure complete recovery of refrigerant, wait for five (5) minutes and watch the manifold gauges for a rise in pressure above "0." If a rise occurs, press **HOLD/CONT**. Repeat as needed until the system pressure holds for two (2) minutes.

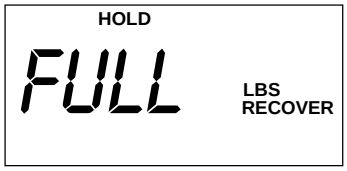
CAUTION! Drain the oil from the separator only after each recovery. Do not completely depressurize the oil separator; immediately close the valve when oil is completely drained in the next step. The lower right corner of the display will indicate "OIL (OUNCES)" as a reminder.

6. Verify the oil catch bottle is empty, then ***slowly*** open the oil drain valve, and drain the oil into the oil catch bottle. This oil was removed from the A/C system during recovery. It must be replaced with new oil. When all the recovered oil has completely drained, immediately close the valve and record the amount of oil in the bottle. Dispose of waste oil in an appropriate manner.

If the recovery tank fills completely:

- **The compressor shuts off; the digital display shows the message "FULL."**
- **Change the tank.**

The A/C system is now empty. Make any repairs at this time.



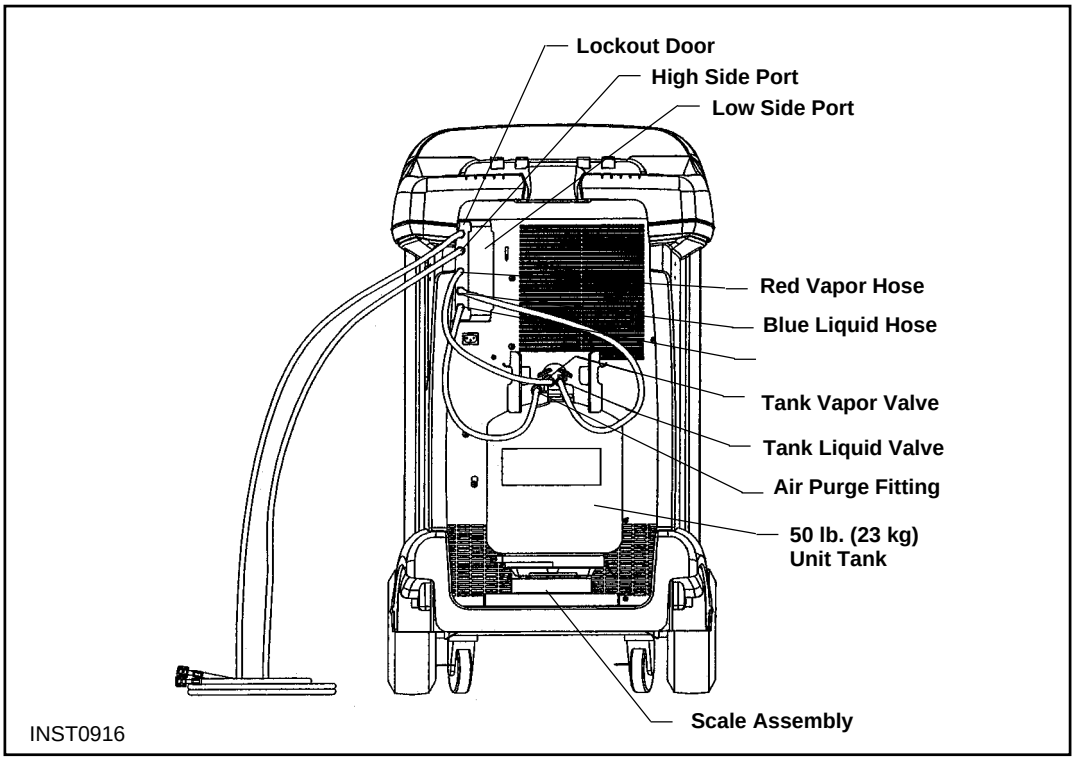


Diagram of Unit's Components — External View

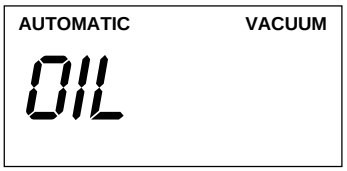
First!
Perform "RECOVERY PROCEDURES" before starting "CHANGING REFRIGERANT TYPES."

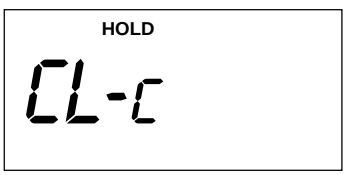
Important!
Before changing refrigerant types, disconnect the red high-side and blue low-side hoses from the A/C system.

CHANGING REFRIGERANT TYPES

1. Verify the red high-side and blue low-side hoses are disconnected from the A/C system, then open the manifold and tank valves.
2. Press and release **SHIFT/RESET** until the "Clr" message appears.
3. Press **HOLD/CONT** to start the system oil separator clearing process.

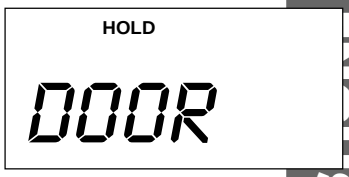
   During the system oil separator clearing process, the compressor is activated and the "OIL" message displays. The compressor will stop while the unit equalizes pressure and the "OIL" message will continue to display. When the unit reaches the correct pressure, the display alternately flashes the messages "OIL" and "drn." Open the system oil drain valve to drain the oil. After all oil has drained, close the oil drain valve. The message changes to "Cont." Press any key to complete the oil separator clearing process. When compressor stops again, the message changes to "CL-c."





4. If you need to change hoses for the next refrigerant type, go to Step 5. If you do not need to change hoses, press **SHIFT/RESET** and go to Step 6.

5. To start the self-clearing process, press **VACUUM** while the "CL-c" message is displayed. The "Clr" message then displays and the vacuum pump runs for 5 minutes before shutting off automatically. The "door" message will then display.



6. Close the tank valves and disconnect the red, blue, and yellow hoses from the tank. Then remove the tank from the unit.

7. If you are using the same hoses for the next refrigerant type, go to Step 11. If you need to change the hoses, go to Step 8.

8. Disconnect all five (5) hoses from the lockout box fittings. If you need to change the door position on the lockout box, go to Step 9. If you do not need to change the door position, go to Step 10.

9. Slide the door on the lockout box to expose the fittings needed for the next refrigerant type.

10. Connect the correct hoses for the next refrigerant to the fittings in the lockout box.

Be sure to use the correct hose set for the refrigerant type selected:

Hose Set	Tank Hoses (3)	System Hoses (2)
R-134a automotive	36", 1/2" Acme with double Quick Seal	96", one Quick Seal with one quick coupler
R-12 automotive	36", 1/4" flare with double Quick Seal	96", 1/4" flare with double Quick Seal
All other refrigerant types	36", 1/4" flare with single Quick Seal	96", 1/4" flare with ball valve

11. Place a tank (already set up for the next refrigerant) on the unit. Connect the red, blue, and yellow hoses to the appropriate tank fittings.

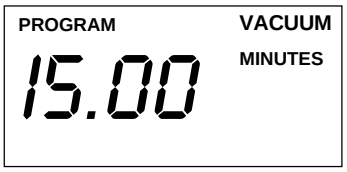
The unit is now ready to process the next refrigerant type.

A/C-R SYSTEM EVACUATION

WARNING!

Wear safety goggles when working with refrigerant. Use only authorized refillable refrigerant tanks. Disconnect hoses using extreme caution!

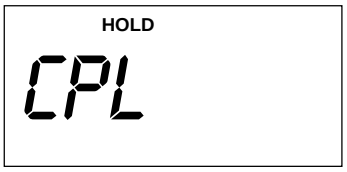
All hoses may contain refrigerant under pressure. Read and follow all warnings at the beginning of this manual before operating the unit.



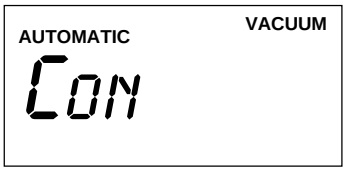
1. Verify the high- and low-side hoses are connected to the A/C-R system, and that the high- and low-side valves are open.

2. Press **SHIFT/RESET** to toggle the display to show "PROGRAM VACUUM MINUTES 15.00." Fifteen minutes is the default time for evacuation. To change the time, press the appropriate keys to display the desired time. Then press **ENTER**.

   The longest time that can be programmed is 98.99 (98 minutes and 99 seconds).



3. Press **VACUUM** to start evacuation. The display counts down the time remaining. If the message "U-HI" appears, you have 25 psi or greater of pressure at the inlet. You must recover that pressure to continue. If necessary, press **RECOVER**.



4. When the programmed time has expired, the vacuum pump automatically shuts off and the display shows "CPL." Press any key to exit vacuum mode.

   To run the vacuum pump continuously, program the time to "99.00," press **ENTER**, then press **VACUUM**. The pump will start and the display will show "CON AUTOMATIC VACUUM." To turn the vacuum pump off, press **HOLD/CONT**.

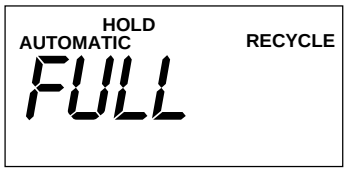
RECYCLING PROCEDURES

WARNING!

Wear safety goggles when working with refrigerant. Use only authorized refillable refrigerant tanks. Disconnect hoses using extreme caution!

All hoses may contain refrigerant under pressure. Read and follow all warnings at the beginning of this manual before operating the unit.

1. Verify both valves on the tank are open.



2. Press and hold **SHIFT/RESET**, then press "1" to start the recycling process.

   If the recovery tank is full, the display will show the message "FULL." Press **HOLD/CONT** to resume operation.

3. After about five (5) minutes of recycling, the tank temperature should equalize. You can then purge non-condensables.

4. To purge non-condensables, check the tank temperature gauge to find the temperature of the refrigerant. Use that temperature to find the correct pressure for that refrigerant on the pressure/temperature chart on the top of the unit. Compare the pressure from the chart to the pressure shown on the tank pressure gauge. If the gauge pressure exceeds the target pressure by more than 10 psi, open the air purge valve on the control panel for about 30 seconds to release non-condensables from the tank. Then close the air purge valve and allow the tank to stabilize for about 30 seconds. Check the tank pressure gauge again. Repeat this step as necessary during the recycling procedure.

   Note: The tank temperature display can show Fahrenheit or Celsius degrees. Refer to *Changing the Temperature Scale* in this manual.

5. To stop recycling, close the tank's LIQUID valve. The unit will pull into a vacuum and shut off automatically. Press any key to exit recycle mode.

Important!

You can stop recycling instantly by pressing HOLD/CONT, then SHIFT/RESET, but this can leave liquid refrigerant in the low side of the unit. Closing the tank's LIQUID valve is the recommended method.

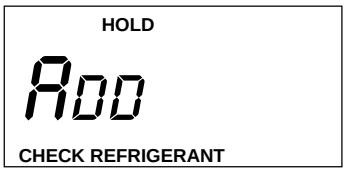
ENGLISH

CHARGING PROCEDURES

WARNING!

Wear safety goggles when working with refrigerant. Use only authorized refillable refrigerant tanks. Disconnect hoses using extreme caution!

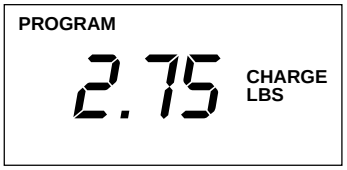
All hoses may contain refrigerant under pressure. Read and follow all warnings at the beginning of this manual before operating the unit.



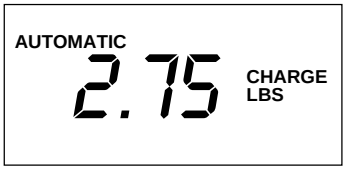
The unit will display the message "CHECK REFRIGERANT" if there are less than six (6) pounds of refrigerant in the tank. The charging system will not function if this message is displayed. If you try to charge in this situation, the display will also show "Add HOLD" to let you know that refrigerant needs to be added to the tank.

Add more refrigerant to the tank than what is needed for charging (see *Adding Refrigerant to the Tank*). To check the weight of refrigerant in the tank, press and hold **SHIFT/RESET**, then press **ENTER** to access the diagnostic mode. Press "7" to display the weight of refrigerant in the tank. Press **SHIFT/RESET** again to exit the diagnostic mode.

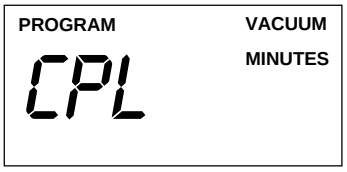
Follow the A/C-R system manufacturer's instructions regarding specific recharging specifications. You must replace any oil lost from the A/C-R system during recovery with new oil. Dispose of waste oil in an appropriate manner.



*Weight Example**



*Weight Example**



**Enter the correct weight for your application.*

1. Open the high-side valve and, if allowable, the low-side valve on the unit's control panel.
2. Press **SHIFT/RESET** until the message "CHG" appears on the display.
3. Press **CHG** and enter the weight of the refrigerant to be charged.
4. Press **ENTER**. The display will flash to indicate that the charge amount has been recorded in the unit's memory.
5. Press **CHG** again to begin the charging process.
6. The display will show the message "AUTOMATIC" and the amount programmed for recharging. The display counts down to zero as charging proceeds.
7. When charging is complete, the display shows the message "CPL."

If the unit beeps continuously, the transfer of refrigerant has stopped before the charging procedure was completed (see *Correcting An Incomplete Transfer*).

8. Close the high- and low-side valves on the control panel, and start the A/C-R system. Compare the gauge readings to the manufacturer's specifications.

9. Turn off the A/C-R system, and disconnect the high-side hose from it.

10. Start the A/C-R system, and open both the high- and low-side valves. This pulls the portion of the programmed charge that is trapped in the hoses into the low side of the A/C-R system.

11. At the lowest recommended operating pressure, close the low-side valve and turn off the A/C-R system. Disconnect the low-side hose from the system.

12. Close the high-side valve, and turn off the **MAIN POWER** switch.

CORRECTING AN INCOMPLETE TRANSFER

If the scale value does not change for 30 seconds, the unit beeps continuously to indicate that the transfer of refrigerant was not completed. There are two reasons for an incomplete transfer of refrigerant:

- The pressure in the A/C-R system is equal to the pressure in the tank. The unit produces an audible signal and shows the weight remaining to complete the transfer.

  1. Close the high-side valve on the control panel.

  2. Disconnect the high-side hose from the A/C-R system.

  3. Continue with Step 9 in *Charging Procedures*.

- The display shows the message "CHECK REFRIGERANT" because there is not enough refrigerant in the tank.

  1. Press **HOLD/CONT** to interrupt the transfer.

  2. Verify both valves on the tank are closed, then disconnect and remove the tank from the unit. Replace it with a tank containing additional refrigerant.

  3. Press **HOLD/CONT** again to resume the transfer.

ADDING REFRIGERANT TO THE TANK

CAUTION! R-134a systems have special fittings (per SAE specifications) to avoid cross-contamination with other refrigerant systems. Read and follow all warnings given at the beginning of this manual.

IMPORTANT! When setting up for new types of refrigerant, a clearing process must be performed.

NOTE: *Purchase only tanks of R-134a refrigerant that have 1/2 inch (1.2cm) Acme threads. This is necessary to match the hose adapter.*

1. Connect the 96-inch (244 cm) blue low-side hose to the unit's low-side port.

NOTE: *Disposable tanks have only one valve and most must be turned upside down to transfer liquid. If you are using a disposable tank, follow the instructions on the side of the tank to obtain a liquid supply.*

2. **When using R-12,** connect the 6-inch (15.2-cm) yellow adapter to the source tank liquid valve *first*. Then connect the 96-inch (244-cm) blue low-side hose to the adapter.

   When using R-134a, connect the low-side connector port adapter to the source tank liquid valve *first*. Then connect the blue 96-inch (244-cm) low-side hose directly to the adapter.

3. Open the LIQUID valve on the source tank. (There is only one valve on a non-refillable tank.)

4. Close the high-side manifold valve, and open the low-side manifold valve on the front panel of the unit. Open both valves on the unit tank.

5. Press **SHIFT/RESET** and **ENTER** at the same time to access the diagnostic mode. The display shows the message “FUNC.”

6. Press **2** to begin transferring refrigerant. The display shows the “Add” message for about two seconds, then shows the amount of refrigerant transferred.

(continued)

7. Transfer stops automatically and the display shows the "CPL" message when the source tank is empty and has been pulled to a partial vacuum **or** the weight of refrigerant in the unit tank reaches 37 pounds. The display toggles between "CPL" and the weight in the tank.

This process takes about 45 minutes. You can interrupt it at any time by pressing **HOLD/CONT** once. Press **HOLD/CONT** again to resume operation, or press **SHIFT/RESET** to end the process. The transfer of new refrigerant is limited by weight to leave space (about 6 pounds of refrigerant) in the unit tank for recovery purposes.

8. **When using R-12**, close the supply valve on the source tank (when using a disposable tank, turn it right side up first). C*arefully* disconnect the 96 inch (244-cm) blue low-side hose from the 6-inch (15.2-cm) yellow adapter, and then remove the yellow adapter from the source tank.

   When using R-134a, close the supply valve on the source tank, (when using a disposable tank, turn it right side up first). *Carefully* disconnect the 96 inch (244-cm) blue low-side hose from the low-side connector port adapter and then remove the adapter from the source tank.

9. Press **RECOVER**. The hose will be pulled into a partial vacuum and the unit will turn off automatically. If the hose is partially clear, the unit will display "CH-P." Press **HOLD/CONT** to finish clearing the hose. Close the low-side manifold valve.

10. Connect the 96-inch (244-cm) red high-side hose to the unit's high-side port. You can also attach an oil injector to the unit's low-side port. Oil injectors will not connect to the wrong ports. The R-12 oil injector has a 1/4 inch flare connector; the R-134a oil injector has a 1/2 inch Acme connector.

Any non-condensable gases in the tank can be removed during the recycling sequence. Your unit is now ready for use.

Weight Example*

** The display shows the weight of refrigerant added to the tank.*

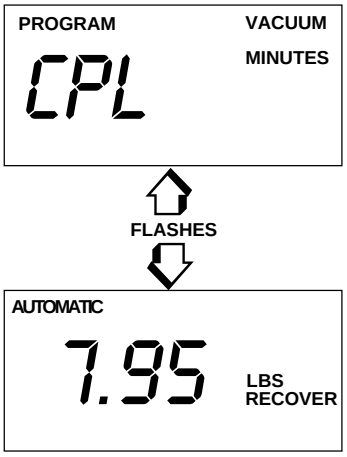
IMPORTANT!
Close both tank valves when the unit is not in use. Inspect the unit periodically for leaks. The manufacturer of the recovery/recycling unit does not reimburse for lost refrigerant.

This overview is designed as a quick reference when using your unit. Read and follow all warnings in the operating manual.

RECOVERY OVERVIEW

1. Connect the high- and low-side hoses to the A/C-R system.
2. Check the manifold gauges. There must be pressure to recover refrigerant.
3. Verify both the high- and low-side valves on the control panel are open. Also verify both valves on the tank are open.
4. Plug the unit into a correct voltage outlet, then turn on the **MAIN POWER** switch.
5. Press **RECOVER**:
   - If there is pressure in the unit, the self-clearing process starts.
   - If there is no internal pressure, refrigerant recovery begins.
   - The unit then shows "RECOVER AUTOMATIC" and the weight of refrigerant being recovered into the tank.
6. Once the recovery and/or self-clearing procedure is complete, the compressor shuts off automatically. The display will flash "CPL" and the weight of refrigerant recovered.
7. If the A/C-R system pressure rises above zero, press **HOLD/CONT** to recover the remaining refrigerant.
8. The display also shows "OIL (OUNCES)." This is a reminder to drain the system oil separator into a suitable container by opening the ball valve on the side of the unit.

   You must replace any oil lost from the A/C-R system during recovery with new oil. Dispose of waste oil in an appropriate manner.



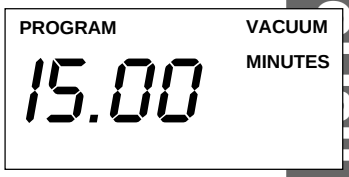
Weight Example

EVACUATION OVERVIEW

1. Verify the high- and low-side hoses are connected to the A/C-R system, and that the high- and low-side valves are open.

2. Press **SHIFT/RESET** to toggle the display to show "PROGRAM VACUUM MINUTES 15.00." Fifteen minutes is the default time for evacuation. To change the time, press the appropriate keys to display the desired time. Then press **ENTER**.

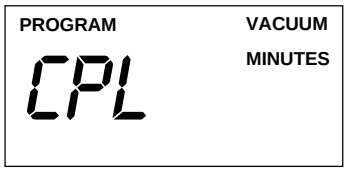
   Note: *The longest time that can be programmed is 98.99 (98 minutes and 99 seconds).*

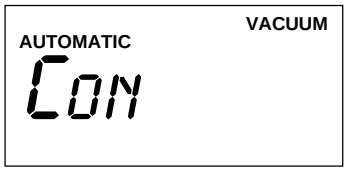


3. Press **VACUUM** to start evacuation. The display counts down the time remaining. If the message "U-HI" appears, there is 25 psi or greater of pressure at the inlet. You must recover that pressure to continue. If necessary, press **RECOVER**.

4. When the programmed time has expired the vacuum pump automatically shuts off and the display shows "CPL."

   To run the vacuum pump continuously, program the time to "99.00," press **ENTER**, then press **VACUUM**. The pump will start and the display will show "CON AUTOMATIC VACUUM." To turn the vacuum pump off, press **HOLD/CONT**.





RECYCLING OVERVIEW

1. Verify both valves on the tank are open. Press and hold **SHIFT/RESET** and then press "1" to start the recycling process.

2. When the tank temperature equalizes (after about five minutes of recycling time), purge non-condensables from the tank. To purge, use the temperature gauge to determine the temperature of the refrigerant. Then use the pressure/temperature chart on the top of the unit to determine the correct pressure for that refrigerant. If the gauge pressure exceeds the target pressure by more than 10 psi, open the air purge valve for about 30 seconds and release non-condensables from the tank.

3. Close the air purge valve and let the tank stabilize (about 30 seconds). Check the air purge gauge again. Repeat Steps 2 and 3 as necessary during the recycling process.

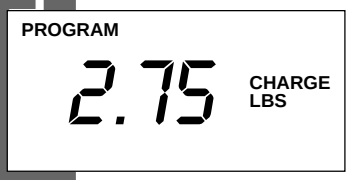
4. Close the tank's LIQUID valve to stop the recycling process. The unit will pull into a vacuum and shut off automatically.

Important!

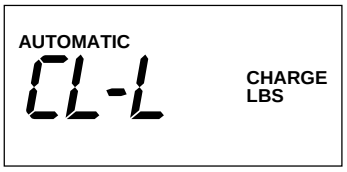
You can stop recycling instantly by pressing HOLD/CONT, then SHIFT/RESET, but this can leave liquid refrigerant in the low side of the unit. Closing the tank's LIQUID valve is the recommended method.

CHARGING OVERVIEW

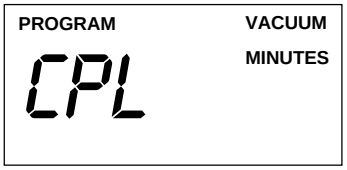
Follow the manufacturer's recommendation for charging. You must replace any oil lost from the A/C-R system during recovery with new oil. Dispose of waste oil in an appropriate manner.



*Weight Example**



*Weight Example**

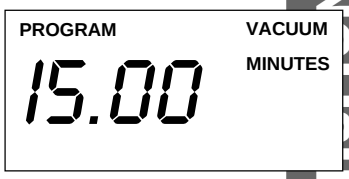


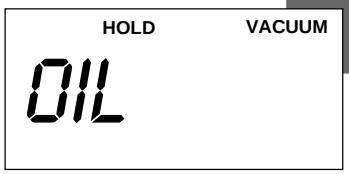
**Enter the correct weight for your application.*

1. Open the high-side valve and, if allowable, the low-side valve.
2. Press **CHG** and enter the weight of the refrigerant to be charged.
3. Press **ENTER**, then press **CHG** again. The display counts down to zero, then shows the "CPL" message when complete.
4. Close the high- and low-side valves and start the A/C-R system. Compare the gauge readings to the manufacturer's specifications.
5. Turn off the A/C-R system and disconnect the high-side hose from it.
6. Start the A/C-R system and open both manifold valves to pull refrigerant from the hoses.
7. At the lowest recommended operating pressure, close the low-side valve and turn off the A/C-R system. Disconnect the low-side hose.
8. Close both manifold valves and turn off the **MAIN POWER** switch.

CHANGING THE VACUUM PUMP OIL

When the vacuum pump has run for a total of 10 hours, the "OIL" message will flash on the display to signal that an oil change is needed. To change the vacuum pump oil, follow these steps:





1. Turn on the **MAIN POWER** switch. The display shows the selected refrigerant type.
2. Press **SHIFT/RESET** and the message "PROGRAM VACUUM MINUTES 15:00" displays.
3. Press **VACUUM**. The display shows the "OIL" message.
4. Remove the door access screws from the right side of the unit. Open the door.
5. Remove the black plastic plug on the oil fill port.
6. Remove the oil drain cap from the vacuum pump, then drain the contaminated oil into a suitable container. (Dispose of it according to local, state, and federal regulations). Replace the oil drain cap.
7. Attach the flexible spout and cap to the oil bottle, and pour approximately six (6) ounces of vacuum pump oil into the oil fill port.
8. Verify the manifold valves are closed, then press **SHIFT/RESET** and **ENTER** at the same time to reset the ten-hour timer.
9. Press **VACUUM**. While the pump is running, ***slowly*** add new vacuum pump oil until the oil level is even with the line on the reservoir's sight glass.
10. Replace the black plastic plug on the oil fill port.

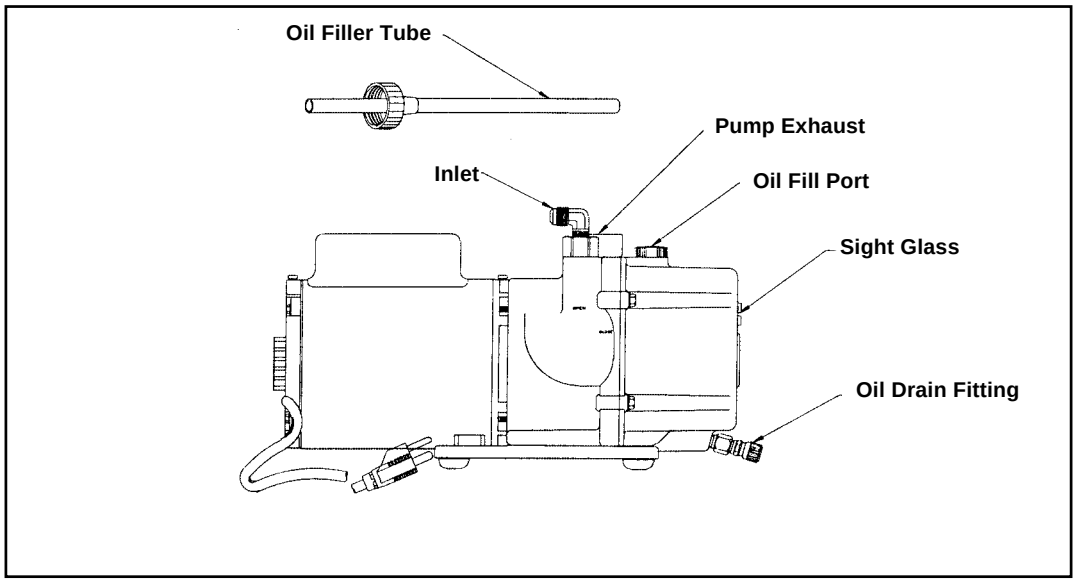
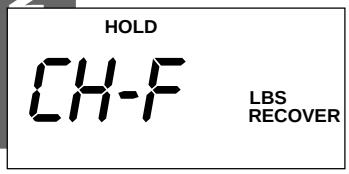
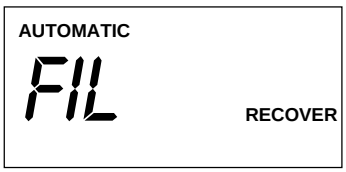


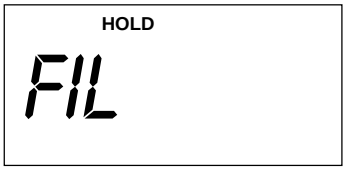
Diagram of Vacuum Pump Components

CHANGING THE FILTER-DRIER

Change the filter-drier whenever refrigerant has been recovered from a burn-out system or when the display shows the “CH-F” message (which means that the unit has recovered 200 pounds of refrigerant since the last change). To change the filter/drier follow these steps:







1. Press and hold **SHIFT/RESET** and then press **FILTER**. The compressor will start and the display will show the messages “FIL” and “AUTOMATIC.”
2. The compressor will shut off when the vacuum switch trips, and the display will show the messages “FIL” and “HOLD.”
3. Turn off the **MAIN POWER** switch and unplug the unit.
4. Remove the door access screws from the right side of the unit. Open the door.
5. Disconnect the hose from the top of the filter-drier, and unscrew the filter-drier by rotating it counterclockwise. (You may need a 5/8" wrench to break it loose.)
6. Open the new filter-drier, and generously lubricate the o-ring with vacuum pump grease. Also lubricate the gasket in the end of the hose that connects to the top of the filter-drier.
7. Replace the greased o-ring into the groove in the manifold. Screw the new filter-drier into place. Reattach the hose with the greased gasket to the top of the filter-drier.
8. Close the cabinet door, and replace the door access screws.
9. Turn on the **MAIN POWER** switch.
10. Press **HOLD/CONT**. The vacuum pump will start, the display will show the messages “FIL AUTOMATIC,” the pump will run for about two minutes, and then shut off. The display will show the message “CPL.”

Important!
Do not remove the new filter-drier from its sealed bag until you are ready to use it.

This procedure automatically resets the filter-drier change counter for another 200 pounds of refrigerant.

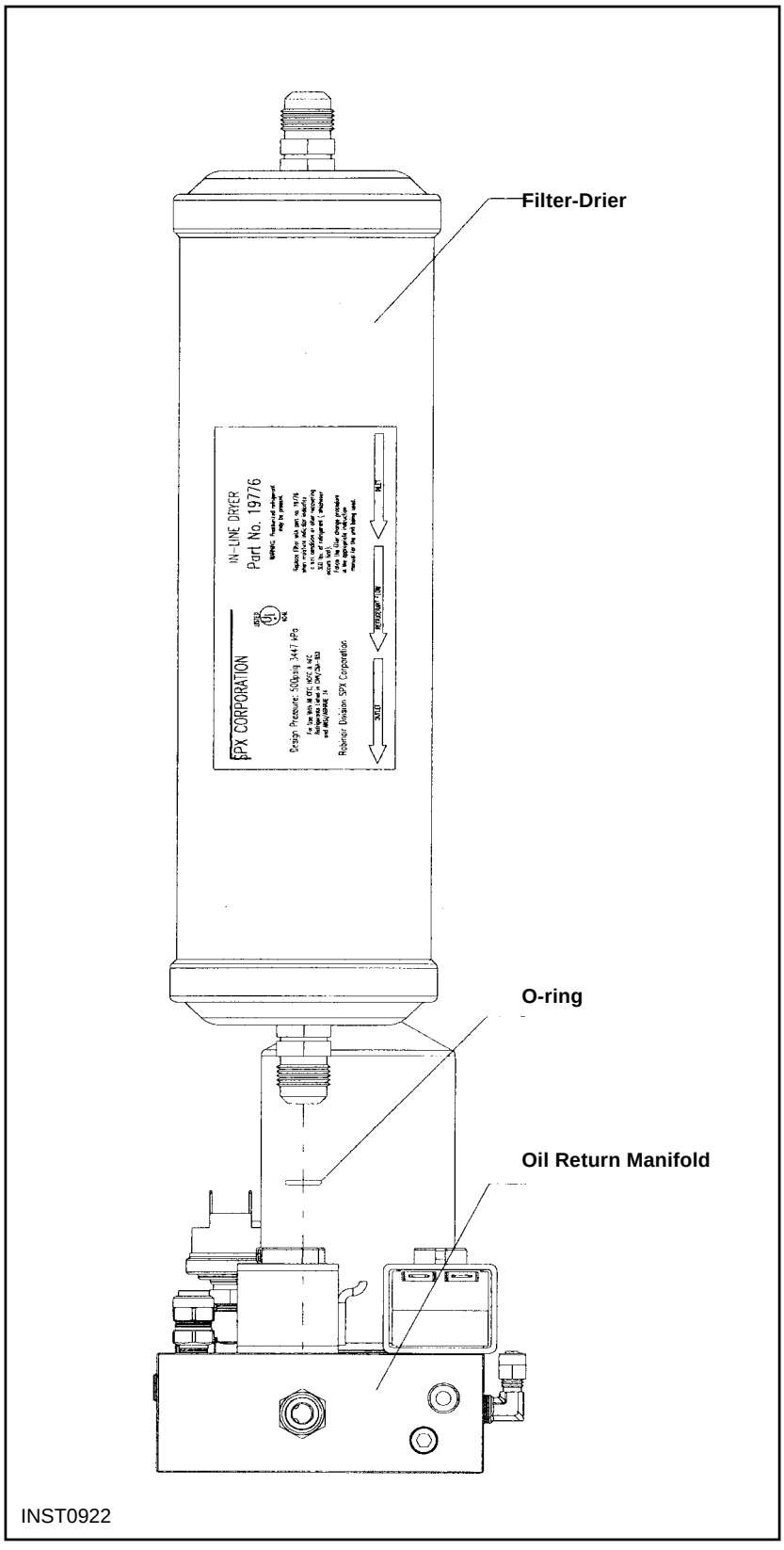


Diagram of Filter-Drier

AUTOMATIC

FIL

HOLD

CPL

CONFIRMING THE SCALE CHECKLIST

Blank Display or No Warnings
Check the wire connections from the scale assembly to the circuit board for configuration and continuity.

Important!
Check the scale accuracy every three months.

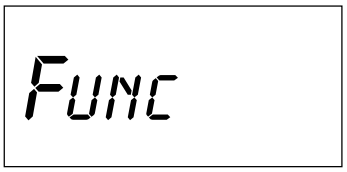
Verify the circuit board is receiving the correct voltage (refer to the decal on the back of the unit), and the two amp or 1/2 amp fuse is not blown. Use correctly grounded, active, electrical outlets only. Replace the circuit board or fuses as needed.

Total Amounts Not Accurate
Verify that nothing is touching, blocking, or interfering in any way with the scale assembly, tank, or hoses. Confirm that the total weight on the scale assembly is not exceeding 80 lb/37 kg. If it is, reduce the amount of refrigerant in the tank.

Full (Full Tank Setting)
The compressor will shut off at the weight previously set. To check the weight of the tank, scale, and refrigerant being recovered, follow the appropriate sections found under *Using the Diagnostic Mode*.

CORRECT WEIGHT VERIFICATION

1. Turn on the **MAIN POWER** switch.



2. Press **SHIFT/RESET** until "PROGRAM" displays.

NOTE: *If the unit is just being turned on, the screen will default to display the selected refrigerant type. Press* ***SHIFT/RESET*** *until "PROGRAM" displays.*

3. When the "PROGRAM" message displays, press and hold **SHIFT/RESET**, then press **ENTER**. The "FUNC" message will display when the manual diagnostic mode has been accessed correctly.

4. Remove all weight from the scale platform.

5. Press **6** to turn the scale into a direct-reading weight scale.

NOTE: *Any weight on the scale when* ***6*** *is pressed will not be shown on the display. The unit automatically zeros the weight on the scale when* ***6*** *is pressed. If you remove the weight, the display will show the change in total weight, but will not show a negative sign.*

6. Place a known weight of between 30-60 lbs./13-28 kg on the scale. The display will show the known weight "± .04lb./.02 kg."

7. If the scale does not read the weight accurately, recalibrate the scale and UL circuit using the following instructions. If the scale does not respond to testing, verify the scale cable is plugged into the main circuit board.

8. Press **SHIFT/RESET** to exit this mode

CALIBRATING THE SCALE

NOTE: *The scale assembly and UL circuit MUST be calibrated when installing a replacement scale assembly or circuit board. To ensure continued charging accuracy, periodically confirm the checklist below.*

1. Remove all weight from the scale platform.

2. Turn on the **MAIN POWER** switch.

NOTE: *If the unit is just being turned on, the screen will default to display the selected refrigerant type.*

3. Press **SHIFT/RESET** and **ENTER** until "PROGRAM" displays.

4. When the "PROGRAM" message displays, press **SHIFT/ RESET** at the same time. The "FUNC" message displays.

5. Press **9.** The display is blank.

6. Press **RECOVER** and **ENTER** at the same time.

7. The DATE message flashes, then "0.00" displays. Enter the current month and year. For example, if the unit is being calibrated on November 8th, 1998, enter **1,1,9,8** and then press **ENTER.**

8. The "CAL" message will flash, then the "ZERO" message displays.

9. Verify nothing is on or touching the scale platform, then press **ENTER**.

10. The "CAL" message will flash, then the "A1" message displays.

11. Place a certified weight (between 20 and 70 lbs.) in the center of the scale platform. Enter the weight from the display. For example, to record 20 lbs. on the scale, press "**2,0,0,0**" on the keypad, then press **ENTER**. The display returns to the vacuum mode.

12. To check scale accuracy, follow the *Correct Weight Verification* procedure.

⚠ WARNING ⚠

Unplug the unit before beginning service work. Imcorrect use or connections can cause electrical shock. Only qualified personnel should perform service work.

If scale assembly and UL circuit are not calibrated, scale can overfill the tank, causing possible explosion and/or vehicle overcharge.

UL CIRCUIT CALIBRATION

NOTE: *Always calibrate the scale first. Then remove the (4) screws that hold down the keypad on the control panel before attempting to calibrate the UL circuit.*

1. Remove all weight from the scale platform.

2. Turn on the **MAIN POWER.**

NOTE: *If the unit is just being turned on, the screen will default to display the selected refrigerant type.*

3. Press **SHIFT/RESET** until "PROGRAM" displays.

4. When the "PROGRAM" message displays, press **SHIFT/RESET** and **ENTER** at the same time. The "FUNC" message displays.

5. Press **6**.

NOTE: *Any weight on the scale when **6** is pressed will not be shown on the display. The unit automatically zeros the weight on the scale when **6** is pressed. If you remove the weight, the display will show the change in total weight, but will not show a negative sign.*

Important!
You must have a known weight of 75 lb. ± .01/ 34.02 kg ±005).

6. Place a known weight of EXACTLY 75 lbs. on the scale platform. The display will show "75 lb. ± .04 lbs/.02kg."

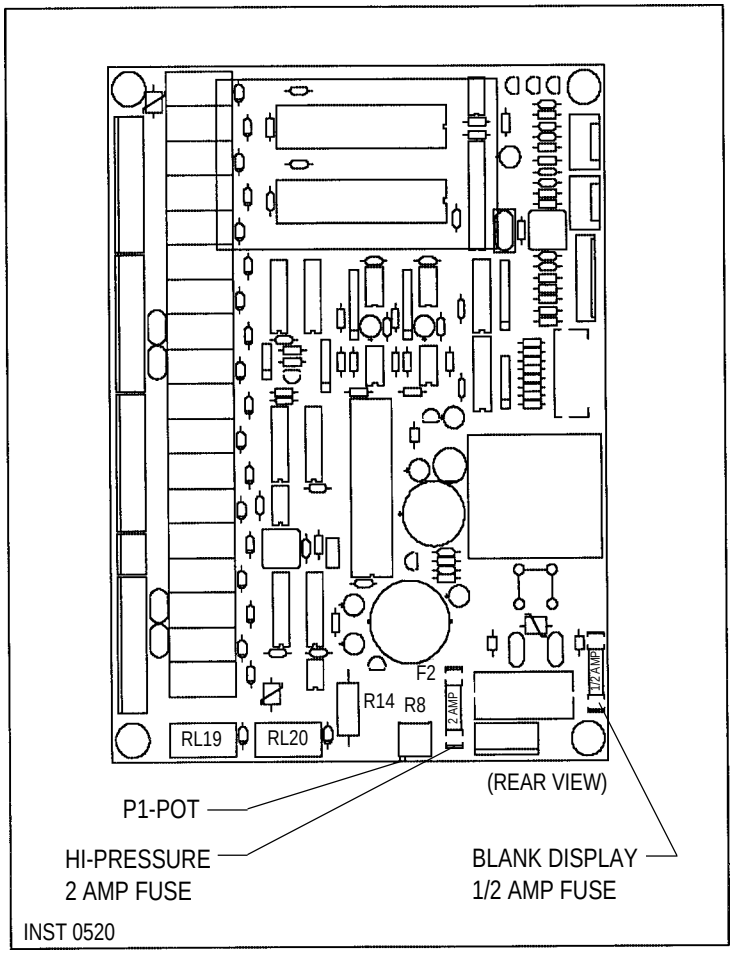
7. Adjust the potentiometer (P1 POT) set screw just until the "HOLD" message displays. (The potentiometer adjusting screw is located on the circuit board.)

NOTE: *Turning the P1 POT* clockwise increases *the weight capacity of the scale. Turning the P1-POT* counterclockwise decreases *the weight capacity of the scale.*

8. Lift the weight from the scale and "HOLD" should appear.

NOTE: *The display should read "HOLD" for 75 lbs. ONLY, not for anything more or less.*

9. If the UL circuit won't calibrate, replace the main circuit board.



CHECKING FOR LEAKS

Important:
Inspect the unit periodically for leaks. The manufacturer does not reimburse for lost refrigerant.

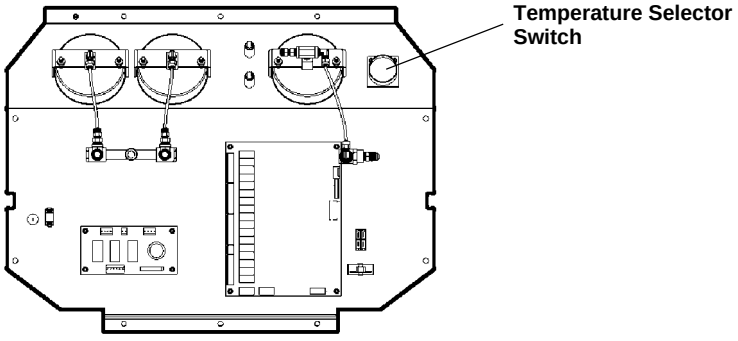
Every three months, or as often as required by local or state laws, check the unit for leaks. As with any mechanical equipment, general use, moving the unit, and vibration can cause fittings to loosen.

1. Turn off the **MAIN POWER** switch, and disconnect the power cord from the outlet.
2. Remove the door access screws from the right side of the unit. Open the door.
3. Use a leak detector to probe all fitting connections for refrigerant leaks. Tighten fittings if a leak is indicated.
4. Close the door and replace the door access screws.

CHANGING THE TEMPERATURE SCALE— FAHRENHEIT OR CELSIUS

The temperature scale is set at the factory. Use the following steps to toggle the temperature scale betweem Fahrenheit and Celsius.

1. Turn off the **MAIN POWER** switch, and disconnect the power cord from the outlet.
2. Remove the four screws that secure the top section of the unit's protective covering, and remove the covering.
3. Locate the selector switch on the back of the tank temperature display.



4. Change the position of the switch to change the temperature scale.
5. Replace the top section of the unit's protective covering, and replace the four screws that secure the covering.

USING THE CONTROL PANEL

MAIN POWER Switch — Supplies electrical power to the control panel.

Digital Display — Shows the time programmed for vacuum, and the weight of refrigerant programmed for recharging. Detailed instructions for programming the digital display follow this section.

Air Purge Indicator — Shows when non-condensables need to be purged from the tank.

LIQUID/VAPOR Indicator — Shows if liquid or vapor refrigerant is being recovered.

System Oil Indicator — Shows when the system oil separator is full and an oil drain needs to be performed.

Low-side Manifold Gauge — Connects to an A/C-R system and shows the system's low-side pressure.

High-side Manifold Gauge — Connects to an A/C-R system and shows the system's high-side pressure.

High-side Valve — Controls the high-side flow from the A/C-R system through the unit.

Low-side Valve — Controls the low-side flow from the A/C-R system through the unit.

Air Purge Valve — Controls the release of non-condensables from the tank.

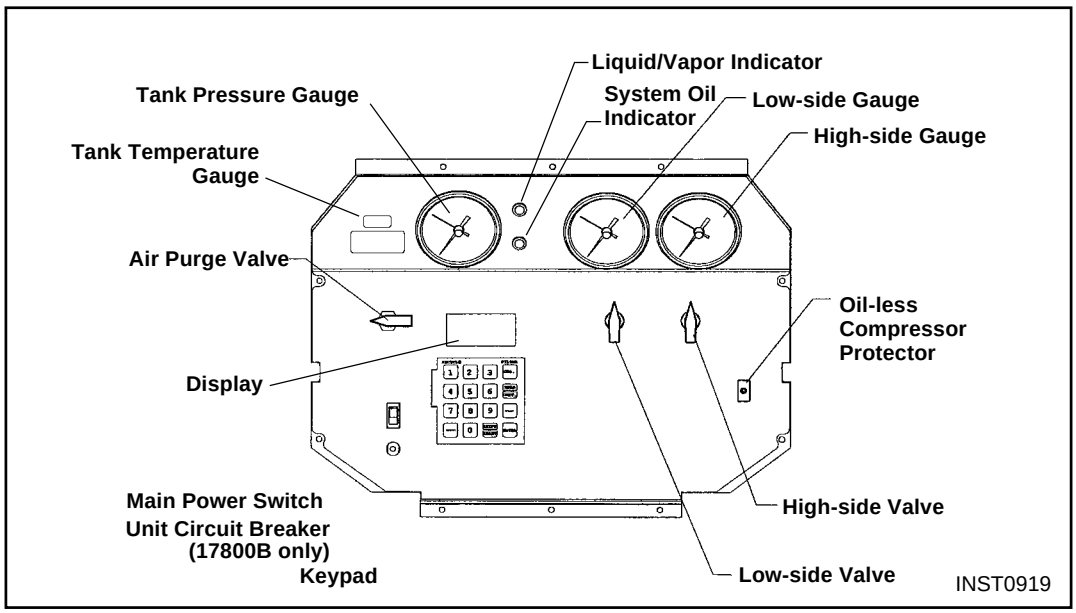


Diagram of Control Panel

KEYPAD FUNCTIONS

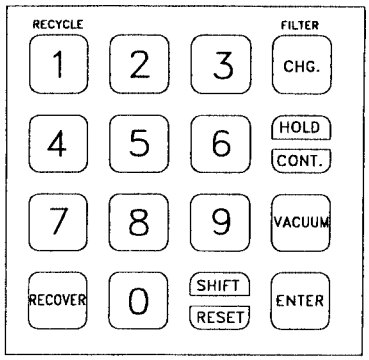


Diagram of Keypad

In addition to the number keys, the keypad contains special keys that accomplish specific operating functions.

- **RECYCLE** — Activates the recycling sequence when pressed at the same time as the **SHIFT/RESET** key.
- **RECOVER** — Activates the recovery sequence.
- **SHIFT/RESET** — Accesses the "PROGRAM" mode and moves from one program function to the next.
- **FILTER** — When pressed at the same time as the **SHIFT/RESET** key, automatically recovers and evacuates to 13 inches of vacuum from the filter and low side of the unit so you can change the filter.
- **CHG** — Automatically charges the A/C-R system with the programmed amount of refrigerant.
- **HOLD/CONT** — Interrupts the "AUTOMATIC" cycle (**HOLD**), and then resumes functions (**CONT**). Press once for **HOLD**, and again for **CONT** (continue).
- **VACUUM** — Activates the vacuum process.
- **ENTER** — Enters programmed data into the unit's memory.

USING THE DIGITAL DISPLAY

This section explains the messages shown on the digital display, which is illustrated here for your convenience.

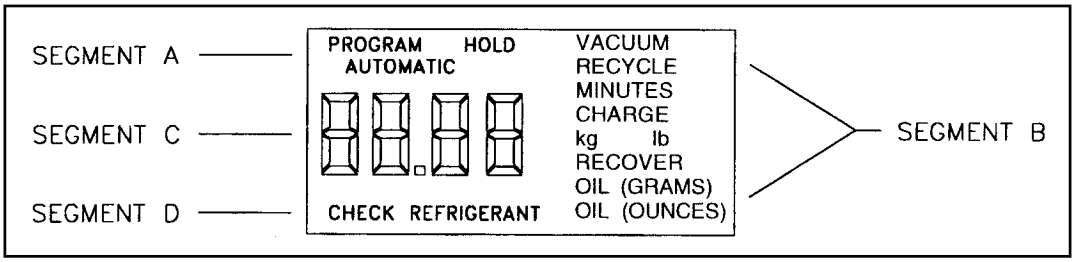


Diagram of Digital Display

Segment A — Indicates in which mode the unit is operating:

PROGRAM — The unit is in the programming mode, which allows you to program vacuum time and refrigerant weight **or** review the existing program.

HOLD — This mode is used to change a refrigerant tank or to interrupt the vacuum/charging/recovery cycles.

AUTOMATIC — Indicates the unit is running in a given cycle and will automatically stop when the cycle is complete. One exception: The recycling process must be stopped by pressing **HOLD/CONT**.

Segment B — Indicates the unit is either evacuating the A/C-R system **OR** recovering, recycling, or recharging refrigerant **OR** that the unit is ready to be programmed for one of the following functions. (Use the chart on the next page as a quick reference for interpreting Segment B messages.)

VACUUM

- With PROGRAM, indicates the unit is ready to be programmed for vacuum.
- With AUTOMATIC, indicates the vacuum pump is running; the number displayed counts down in minutes and seconds, showing the amount of time remaining.
- With HOLD, indicates that **HOLD/CONT** was pressed to interrupt the vacuum cycle.

RECYCLE

- With AUTOMATIC, indicates the unit is recycling refrigerant from the tank.

CHARGE

- With PROGRAM, indicates the unit is ready to be programmed for the amount of refrigerant to be charged into the A/C-R system; on the keypad, enter the charge in pounds and hundredths of a pound or kilograms, depending on the measurement mode selected.
- With AUTOMATIC, indicates the unit is charging refrigerant into the A/C-R system; the number shown on the digital display counts down, showing the remaining amount of refrigerant to be dispensed.
- With HOLD, indicates that **HOLD/CONT** was pressed to interrupt the charging cycle; the number shown on the digital display is the amount of refrigerant remaining to be charged into the A/C-R system; to continue charging, press **HOLD/CONT** again.

RECOVER

- With AUTOMATIC, indicates the unit is recovering refrigerant from the A/C-R system and shows the amount of refrigerant recovered in pounds or kilograms, depending on the measurement mode selected.

OIL (OUNCES) or OIL (GRAMS)

- Lights up as a reminder to drain the oil separator after each job.

Segment C — Shows a number or a coded error message on the digital display that indicates the unit's operating status or any specific problems. See *Trouble-shooting* for a list of error codes and messages.

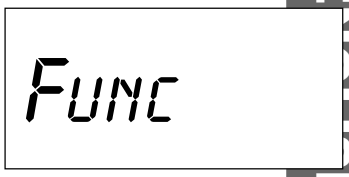
Segment D — Indicates that refrigerant is low — approximately six pounds (or 2.7 kilograms) of refrigerant is left in the tank. Either replace the tank or add refrigerant to the tank.

VACUUM	**+**	**PROGRAM**	**=**	**Program unit for vacuum**
VACUUM	**+**	**AUTOMATIC**	**=**	**Vacuum pump is running**
VACUUM	**+**	**HOLD**	**=**	**Interrupted vacuum cycle**
RECYCLE	**+**	**AUTOMATIC**	**=**	**Unit is recycling refrigerant**
CHARGE	**+**	**PROGRAM**	**=**	**Program unit for charge**
CHARGE	**+**	**AUTOMATIC**	**=**	**Unit is charging A/C-R system**
CHARGE	**+**	**HOLD**	**=**	**Interrupted charging cycle**
RECOVER	**+**	**AUTOMATIC**	**=**	**Unit is recovering refrigerant**

Quick Reference Chart for Segment B

USING THE DIAGNOSTIC MODE

The diagnostic mode allows you to run individual components or retrieve stored information. To access the diagnostic mode, press and hold **SHIFT/RESET** and then press **ENTER**. The display will show the message "FUNC." To exit the diagnostic mode, press **SHIFT/RESET** again.



Some diagnostic functions exit the diagnostic mode when completed, so to continue with more diagnostic functions you must re-enter the diagnostic mode.

Once in the diagnostic mode you can do the following:

Initial Vacuum Mode:

1. Press **1** to enter initial vacuum mode. The display will show the message "VACUUM." The use of this mode is described in the intial setup instructions in this manual.
2. Press **HOLD/CONT** to stop the pump.

Set Display for Pounds or Kilograms:

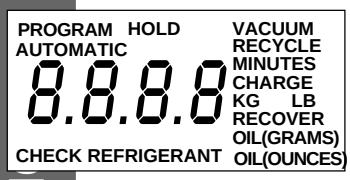
1. Press "0" to display the unit of measure currently set (the unit assumes you want to change the setting).
2. Press **ENTER** to toggle between "lb" and "kg".
3. When the desired setting displays, press **SHIFT/RESET** to save the selection.

Display Total Weight of Recovered Refrigerant:

1. Press "3" to display the total amount of refrigerant recovered by the unit since the last filter-drier change.
2. This counter resets with every filter-drier change.

Important!

To access the diagnostic mode, press and hold SHIFT/RESET and press ENTER. The display will show the message "FUNC." To exit the diagnostic mode, press SHIFT/RESET again.



Example of Full Display Test

To Test Full Display:

1. Press “5” to see the complete LCD display, which displays only momentarily before returning to Program mode.
2. Press any key to exit.

To Access Scale Function:

1. Press “6” to zero-out the display (regardless of what is on the scale platform). The weight of anything you add to the scale platform will now display.
2. Press **SHIFT/RESET** to exit.

To Display Weight of Refrigerant in Tank:

1. Press “7” to display the weight of refrigerant in the tank.
2. Press any key to exit.

USING DISPLAY CODES

134A . . . . . R-134a; indicates R-134a automotive refrigerant requiring $^1/_2$" Acme fittings.

Add . . . . . Add refrigerant to the tank before starting charging procedures.

CAL . . . . . The scale is out of calibration; see *Calibrating the Scale*.

Check Refrigerant . . . . . Tank has six (6) pounds or less of refrigerant; charging will not activate.

CH-F . . . . . Change filter/drier; 200 pounds of refrigerant has been recovered since the last change.

CH-P . . . . . A/C-R system pressure is low; prevents pulling air into the unit from a leaky system.

CL-c . . . . . Clearing complete; indicates the first stage of the clearing process is complete.

CL-L . . . . . The low-side clearing routine is in progress; this occurs when you press **RECOVER** and can last up to four minutes.

Clr . . . . . Self-clearing; if this message is displayed, the unit is in the self-clearing process.

CON . . . . . The vacuum pump will run continuously; press **SHIFT/RESET** to stop.

CPL . . . . . Complete; the current procedure is finished.

Door . . . . . (Flashes) The unit has been cleared, and you can now select a door position. Slide the refrigerant lockout panel (located on the back of the unit, top left corner) to expose the fittings for the selected refrigerant type.

OIL/drn . . . . . (Flashes alternately) Drain; open the oil drain valve to relieve the pressure in the unit.

FIL . . . . . Compressor oil and filter/drier change procedures are being performed.

FULL . . . . . The tank is full; recovery stops automatically.

HI-P . . . . . High pressure; unit pressure is greater than 435 psi.

OIL . . . . . . Change vacuum pump oil; it has been 10 hours since the last oil change.

R12 . . . . . . R-12; indicates R-12 or other refrigerant type requiring 1/4" flare fittings.

SCAL . . . . . . Scale problem; the scale is broken or disconnected, or the tank has exceeded 75 pounds gross weight.

U-HI . . . . . . High pressure to vacuum pump; prevents blowing refrigerant through the vacuum pump. To relieve pressure, perform a recovery process (see *Operating Instructions*).

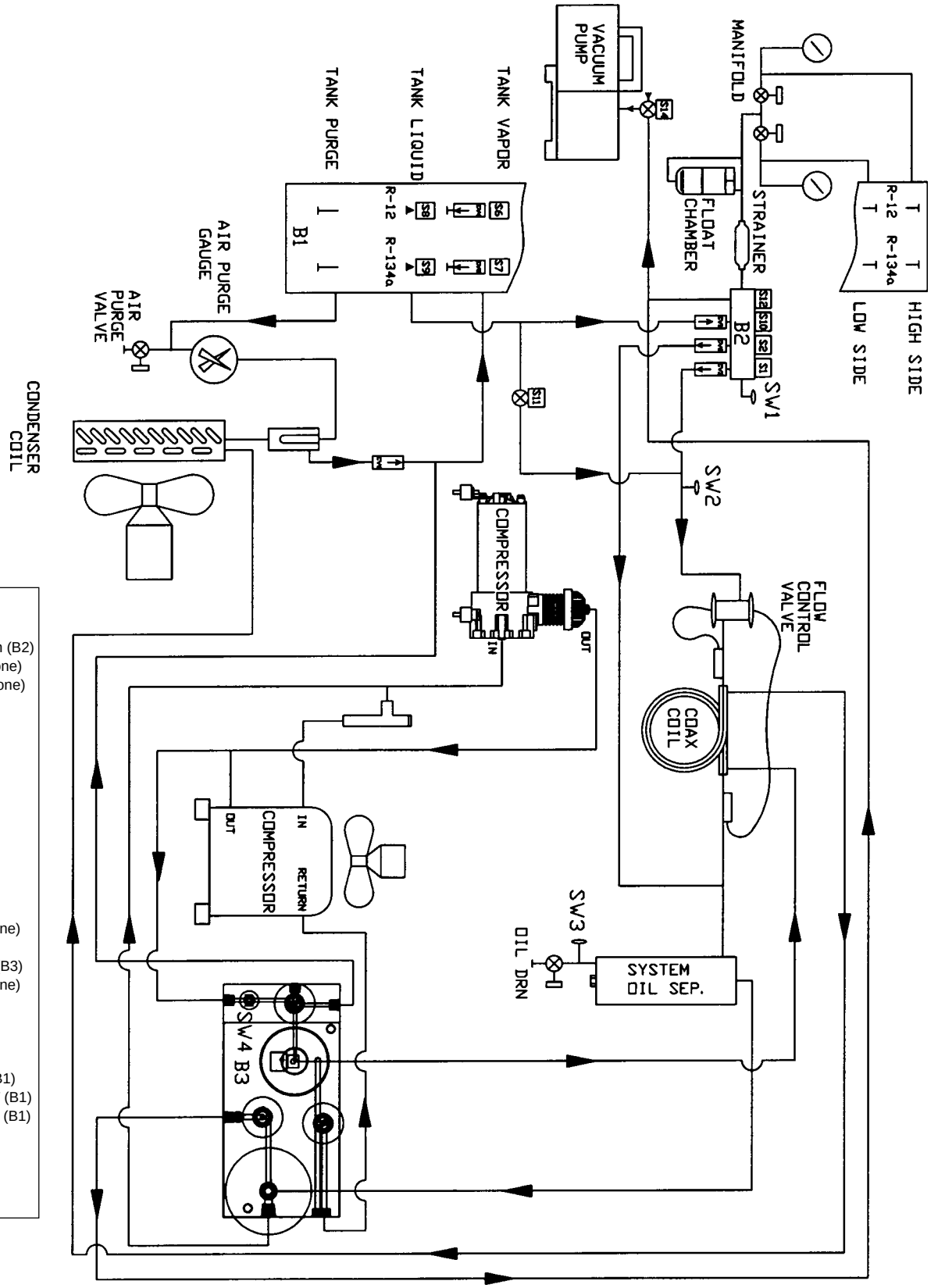
Following is a list of replacement parts and accessories you may need to service or maintain your unit. Tanks, filter-drier, and vacuum pump oil should be purchased through your regular Robinair distributor.

Description	Part No.
50 lb. (23 kg) tank,¼ in. flare fittings	17506
50 lb. (23 kg) tank,½ in. Acme fittings	34750
36" Yellow Hose, Single Quick Seal	19293
36" Red Hose, Single Quick Seal	68336A
36" Blue Hose,Single Quick Seal w/valve core depressor	19339
36" Red Hose, Auto Shut Off	19312
36" Blue Hose,Auto Shut Off	19311
36" Yellow Hose,Auto Shut Off	19310
36" Blue Acme Hose	19306
36" Red Acme Hose	19307
36" Yellow Acme Hose	19313
96" Red Hose, With Ball Valve	19296
96" Blue Hose, With Ball Valve	19298
96" Red Hose, Auto Shut Off	19308
96" Blue Hose, Auto Shut Off	19309
96" Red Acme Quick Seal Hose	19328
96" Blue Acme Quick Seal Hose	19329
Coupler (½ Acme x Service Coupler)	16301
Quick Change Filter	19776
R-134a Low-side Coupler	18190A
R-134a High-side Coupler	18191A
Vacuum Pump Oil (1 case of quart bottles)	13203

Because of ongoing product improvements, we reserve the right to change design, specifications, and materials without notice.

Flow Diagram

ENGLISH

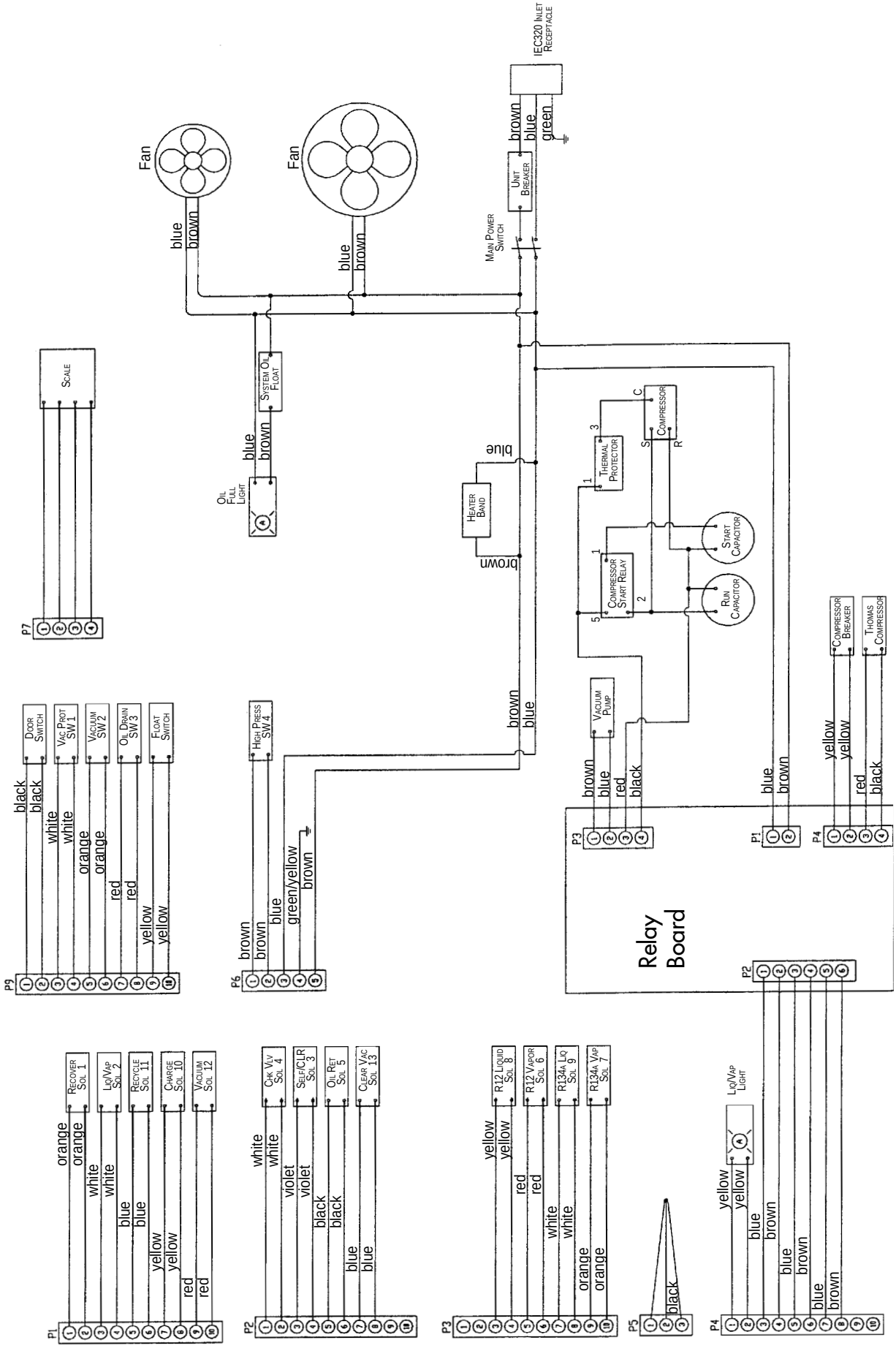


Component List

	SWITCHES
SW1	Vacuum Protection (B2)
SW2	Vacuum (stand alone)
SW3	Oil Drain (stand alone)
SW4	HPCO (B3)
	SOLENOIDS
S1	Recover (B2)
S2	Liq/Vap (B2)
S3	Self/CLR (B3)
S4	Chk Vlv (B3)
S5	Oil Return (B3)
S6	R12 Vapor (B1)
S7	134a Vapor (B1)
S8	R12 Liquid (B1)
S9	134a Liquid (B1)
S10	Charge (B2)
S11	Recycle (stand alone)
S12	Vacuum (B2)
S13	Clearing/Vacuum (B3)
S14	Free Air (stand alone)
	CHECK VALVES
C1	Charge (B2)
C2	Vapor IN (B2)
C3	Liquid IN (B2)
C4	R12 Vapor OUT (B1)
C5	R134a Vapor OUT (B1)
C6	High-side Clearing (B1)
	BLOCKS
B1	Bulkhead
B2	Inlet
B3	Filter/Oil Sep.

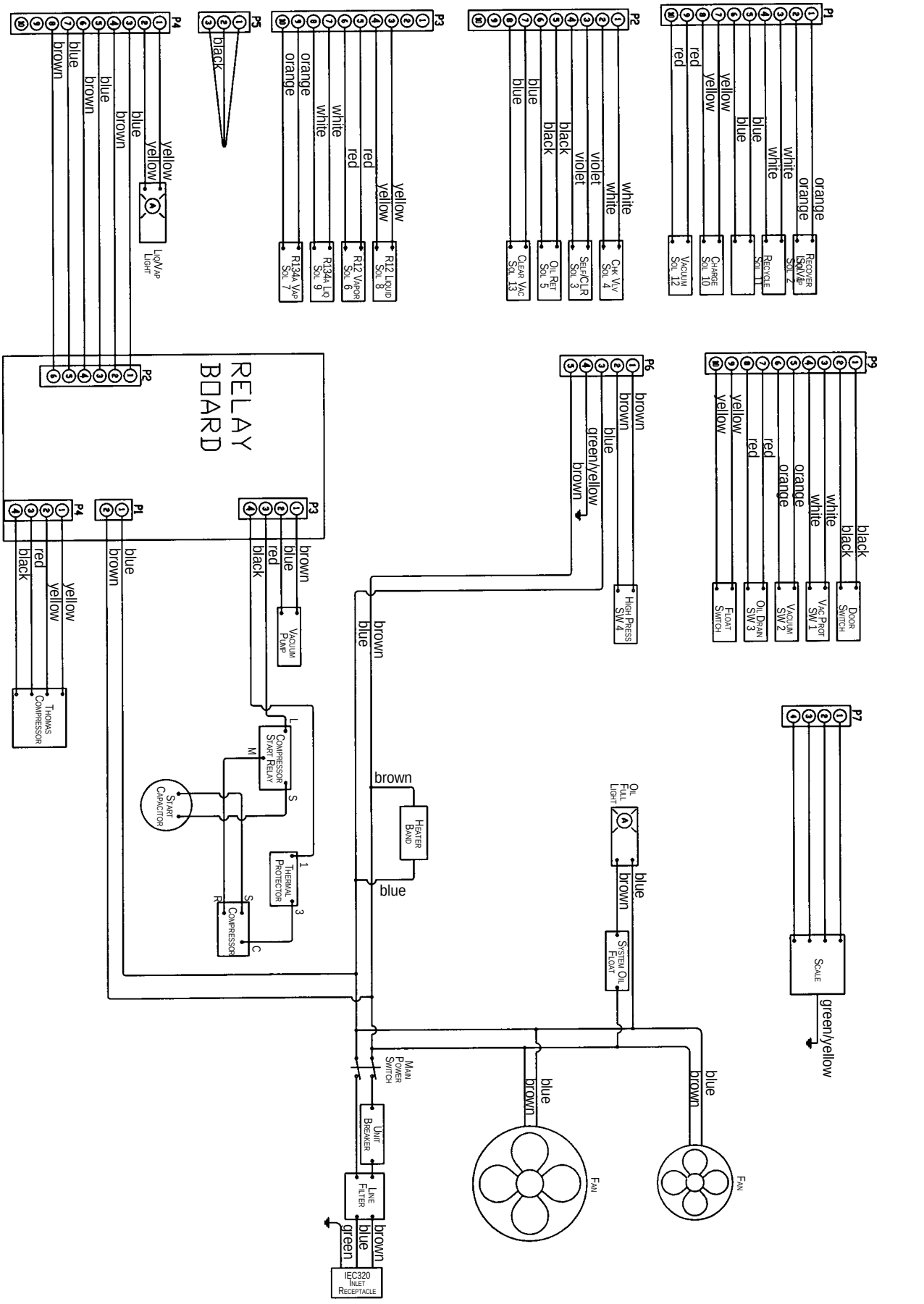
INST0923

INST0924


IEC320 Inlet Receptacle
brown
blue
green
Unit Breaker
Main Power Switch
Fan
blue
brown
Fan
blue
brown
Scale
P7
System Oil Float
blue
brown
Oil Full Light
blue
Heater Band
brown
Thermal Protector
Compressor
Start Capacitor
Run Capacitor
Compressor Start Relay
Vacuum Pump
Compressor Breaker
Thomas Compressor
brown
blue
red
black
yellow
yellow
blue
brown
P3
P1
P4
Relay Board
P2
Door Switch
Vac Prot SW 1
Vacuum SW 2
Oil Drain SW 3
Float Switch
black
white
orange
red
yellow
P9
High Press SW 4
brown
blue
green/yellow
P6
Recover Sol 1
Liq/Vap Sol 2
Recycle Sol 11
Charge Sol 10
Vacuum Sol 12
orange
white
blue
yellow
red
P1
Chk Vlv Sol 4
Self/Clr Sol 3
Oil Ret Sol 5
Clear Vac Sol 13
white
violet
black
blue
P2
R12 Liquid Sol 8
R12 Vapor Sol 6
R134a Liq Sol 9
R134a Vap Sol 7
yellow
red
white
orange
P3
P5
black
Liq/Vap Light
yellow
blue
brown
P4

Wiring Diagram17801B

ENGLISH



RECOVERY OPERATION

Compressor does not start

Problem: Main power switch is off.
Solution: Turn on switch.

Problem: Power cord is not plugged in, or there is no power at plug.
Solution: Check circuit for power.

Problem: "FULL" message shows on digital display.
Solution: Change tanks (see *Installing a Tank and Pulling A Vacuum*).

Problem: "HI-P" message shows on digital display.
Solution: Verify tanks valves are open and hoses are connected to the tank, **or**
Check for air in the tank (recycle tank to purge any air), **or**
Check the scale calibration (see *Checking the Scale Accuracy*).

Note: *If the"HI-P" message does not disapear in 20 minutes, the pressure will have to be released manually. Recover the pressure from the HI-P Access Port shown on page 4 in the Diagram of Units Components - Internal View.*

Problem: "CH-F" message on digital display.
Solution: Remove and replace the filter-drier (see *Replacing the Filter-Drier*), and pull a vacuum before continuing.

Runs for a short time but does not complete recovery

Problem: Tank valves are closed.
Solution: Open both valves and verify hoses are connected to the tank.

Problem: Manifold valves are closed.
Solution: Open both valves.

Runs but will not shut off

Problem: Oil drain valve is open.
Solution: Close the oil drain valve.

Problem: There is a leak in the A/C-R system.
Solution: Locate and repair all system leaks.

Problem: Hoses are not connected to the vehicle.
Solution: Check hose connections.

Problem: Oil return solenoid is open.
Solution: Replace the oil return solenoid.

RECYCLING OPERATION

Compressor does not start, or stops prematurely

Problem: Power cord is not plugged in, or there is no power at plug.
Solution: Check circuit for power.

Problem: Tank valves are closed.
Solution: Open both valves, and verify hoses are connected to the tank.

Problem: "CH-F" message on digital display.
Solution: Remove and replace the filter-drier (see *Replacing the Filter-Drier*), and pull a vacuum before continuing.

Refrigerant does not flow

Problem: Refrigerant supply empty or low.
Solution: Add refrigerant to the tank.

Problem: Tank valves are closed.
Solution: Open both valves, and verify hoses are connected to the tank and the unit.

RECHARGING OPERATION

No power when MAIN POWER switch is on — no display showing

Problem: Power cord is not plugged in, or there is no power at plug.
Solution: Check circuit for power.

Problem: The "CHECK REFRIGERANT" message is displayed.
Solution: There are less than 6 pounds of refrigerant in the tank; add refrigerant to the tank.

Audible tone sounds during refrigerant transfer

Problem: Transfer stopped or too slow.
Solution: Close the high-side valve, then start the A/C-R system and pull the remaining refrigerant into the system.

Problem: Refrigerant supply is low or empty.
Solution: Add refrigerant to the tank or change tanks.

Problem: Tank valves are closed.
Solution: Open both valves, and verify hoses are connected to the tank and the unit.

EVACUATION OPERATION

Vacuum pump will not start

Problem: Power cord is not plugged in, or there is no power at plug.
Solution: Check circuit for power.

Problem: The pressure in the A/C-R system is too high.
Solution: Recover the remaining A/C-R system charge.

Problem: "U-HI" message on digital display.
Solution: Recover all refrigerant before pulling a vacuum.

Problem: Vacuum time not entered.
Solution: Program the required time for vacuum.

Vacuum pump runs, but low-side gauge does not register an appropriate vacuum

Problem: Low-side valve is closed.
Solution: Open the low-side valve.

Problem: Pump oil is contaminated.
Solution: Flush and change the vacuum pump oil.

Problem: Hose connection is loose, or manifold is leaking.
Solution: Check connections.

CLEARING OPERATION

"CLR" displays on screen

Problem: Pressing **HOLD/CONT** does not clear the display.
Solution: Slide the lockout panel on the back of the unit to expose the fittings for the correct refrigerant type. Connect the appropriate hoses, and perform a clearing procedure (see Step 12 in *Setup Instructions*).

Robinair Limited Warranty Statement

Rev. November 1, 2005

This product is warranted to be free from defects in workmanship, materials, and components for a period of one year from date of purchase. All parts and labor required to repair defective products covered under the warranty will be at no charge. The following restrictions apply:

1. The limited warranty applies to the original purchaser only.
2. The warranty applies to the product in normal usage situations only, as described in the Operating Manual. The product must be serviced and maintained as specified.
3. If the product fails, it will be repaired or replaced at the option of the manufacturer.
4. Transportation charges for warranty service will be reimbursed by the factory upon verification of the warranty claim and submission of a freight bill for normal ground service. Approval from the manufacturer must be obtained prior to shipping to an authorized service center.
5. Warranty service claims are subject to authorized inspection for product defect(s).
6. The manufacturer shall not be responsible for any additional costs associated with a product failure including, but not limited to, loss of work time, loss of refrigerant, cross-contamination of refrigerant, and unauthorized shipping and/or labor charges.
7. All warranty service claims must be made within the specified warranty period. Proof-of-purchase date must be supplied to the manufacturer.
8. Use of recovery/recycling equipment with unauthorized refrigerants or sealants will void warranty.
   - Authorized refrigerants are listed on the equipment or are available through the Technical Service Department.
   - The manufacturer prohibits the use of the recovery/recycling equipment on air conditioning (A/C) systems containing leak sealants, either of a seal-swelling or aerobic nature.

This Limited Warranty does NOT apply if:

- The product, or product part, is broken by accident.
- The product is misused, tampered with, or modified.
- The product is used for recovering or recycling any substance other than the specified refrigerant type. This includes, but is not limited to, materials and chemicals used to seal leaks in A/C systems.

Notes

ENGLISH

Conversion Table

Tabla de conversión

Table de Conversion

OZ. onzas	LBS. libras
0.5	0.03
1.0	0.06
1.5	0.09
2.0	0.13
2.5	0.16
3.0	0.19
3.5	0.22
4.0	0.25
4.5	0.28
5.0	0.31
5.5	0.34
6.0	0.38
6.5	0.41
7.0	0.44
7.5	0.47
8.0	0.50
8.5	0.53
9.0	0.56
9.5	0.59
10.0	0.63
10.5	0.66
11.0	0.69
11.5	0.72
12.0	0.75
12.5	0.78
13.0	0.81
13.5	0.84
14.0	0.88
14.5	0.91
15.0	0.94
15.5	0.97
16.0	1 lb.

Call our toll-free Technical Support Line in the continental U.S. or Canada.

Llame sin costo Línea de Asistencia Técnica de EE. UU. continental o Canadá.

Appelez sans frais la ligne de soutien technique sur le territoire continental des États-Unis ou au Canada.

800-822-5561

In all other locations, contact your local distributor. To help us serve you better, be prepared to provide the model number, serial number, and date of purchase of your unit.

To validate the warranty, complete the warranty card attached to your unit, and return it within ten days from date of purchase.

NATIONWIDE NETWORK OF AUTHORIZED SERVICE CENTERS

If your unit needs repairs or replacement parts, contact the service center in your area. For help in locating a service center, call the toll-free technical support line.

En todas las demás ubicaciones, comuníquese con su distribuidor local. Para ayudarnos a servirle mejor, tenga a mano el número de modelo, número de serie y fecha de compra de su unidad.

Para validar la garantía, complete la tarjeta de garantía anexa a su unidad, y envíela de vuelta dentro de los diez días siguientes a la fecha de compra.

RED NACIONAL DE CENTROS DE SERVICIO AUTORIZADOS

Si su unidad necesita reparaciones o partes de reemplazo, comuníquese con el centro de servicio de su área. Para obtener ayuda para localizar un centro de servicio, llame sin costo a la línea de asistencia técnica.

Pour tout autre endroit, communiquez avec votre distributeur local. Afin de nous aider à mieux vous servir, soyez prêt à nous donner le numéro de modèle, le numéro de série et la date de l'achat de votre unité.

Afin de valider votre garantie, remplissez la carte de garantie jointe à votre système et retournez-la dans les dix jours de la date d'achat.

RÉSEAU NATIONAL DES CENTRES DE SERVICE AUTORISÉS

Si votre unité a besoin d'être réparée ou à besoin de pièces de remplacement, communiquez avec le centre de service de votre région. Pour vous aider à localiser un centre de service, appelez sans frais la ligne de soutien technique.

This equipment is designed to meet all applicable agency certifications, including Underwriter's Laboratories, Inc., SAE Standards, and CUL. Correct maintenance of this equipment will provide accurate A/C service for many years.

Certain state and local jurisdictions dictate that using this equipment to sell refrigerant by weight may not be permitted. We recommend charging for any A/C service by the job performed.

This weight scale provides a means of metering the amount of refrigerant needed for optimum A/C system performance as recommended by OEM manufacturers.

Este equipo está diseñado para cumplir con todas las certificaciones de agencia aplicables, incluyendo Underwriter's Laboratories, Inc., Estándares SAE y CUL. El mantenimiento correcto de este equipo proporcionará servicio exacto de aire acondicionado por muchos años.

Ciertas jurisdicciones estatales y locales prescriben que el uso de este equipo para vender refrigerante por peso es posible que no sea permitido. Recomendamos que se cobre el trabajo realizado por dar servicio al aire acondicionado.

Esta escala de peso proporciona un medio para medir la cantidad de refrigerante que se necesita para el rendimiento óptimo del sistema de aire acondicionado, tal como lo recomiendan los fabricantes OEM.

Cet équipement a été conçu pour répondre aux certifications applicables de la Underwriter's Laboratories, Inc., aux normes SAE et CUL. Un entretien approprié de cet équipement permettra d'obtenir un service satisfaisant du système de climatisation et ce, pour plusieurs années à venir.

Certains endroits dictent l'utilisation de cet équipement et il peut arriver que la vente de fluide frigorigène en fonction du poids puisse être interdite. Nous vous recommandons de facturer les services de climatisation en fonction du travail effectué.

Ce poids de tarification offre un moyen de compter la quantité de fluide frigorigène qui est nécessaire pour un rendement maximum du système de climatisation, comme il est recommandé par les fabricants de l'équipement d'origine.

SPX ROBINAIR

SPX Corporation
655 Eisenhower Drive
Owatonna, MN 55060-0995 USA
Phone : 800-822-5561
Fax : 419-690-2001

Due to ongoing product improvements, we reserve the right to change design, specifications, and materials without notice.

Debido a las constantes mejoras del producto, nos reservamos el derecho de cambiar diseño, especificaciones y materiales sin aviso.

En raison des améliorations constantes apportées à nos produits, nous nous réservons le droit de changer de concept, de spécifications et de matériaux sans préavis.

CHAPTER 12

MAINTENANCE ALLOCATION CHART (MAC)

INTRODUCTION

The Army Maintenance System MAC

This introduction provides a general explanation of all maintenance and repair functions authorized at the two maintenance levels under the Two-Level Maintenance System concept.

This MAC designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component shall be consistent with the capacities and capabilities of the designated maintenance level, which are shown on the MAC in column (4) as:

Field –- includes two columns, Unit Maintenance and Direct Support maintenance. The Unit maintenance column is divided again into two more subcolumns, C for Operator or Crew and O for Unit maintenance.

Sustainment –- includes two subcolumns, General Support (H) and Depot (D).

The tools and test equipment requirements list the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from the MAC.

The remarks contain supplemental instructions and explanatory notes for a particular maintenance function.

Maintenance Functions

Maintenance functions are limited to and defined as follows:

1. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g. by sight, sound, or feel). This includes scheduled inspection and gagings and evaluation of common tubes.

2. Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards on a scheduled basis; i.e., load testing of lift devices and hydrostatic testing of pressure hoses.

3. Service. Operations required periodically to keep an item in proper operating condition, e.g. to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases. This includes scheduled exercising and purging of recoil mechanisms. The following are examples of service functions:
   a. Unpack. To remove from packing box for service or when required for the performance of maintenance operations.
   b. Repack. To return item to packing box after service and or maintenance operation.
   c. Clean. To rid the item of contamination.
   d. Touch up. To spot paint scratched or blistered surfaces.
   e. Mark. To restore obliterated identifications.

Maintenance Functions – Continued

4. Adjust. To maintain or regulate, within prescribed limits, by bringing into proper position, or by setting the operating characteristics to specified parameters.

5. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

6. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments of Test, Measurement, and Diagnostic Equipment (TMDE) used in precision measurement. Consists of comparison of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

7. Remove/Install. To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

8. Paint. To prepare and spray color coats of paint so that the ammunition can be identified and protected. The color indication primary use is applied, preferably, to the entire exterior surface as the background color of the item. Other markings are to be repainted as original so as to retain proper ammunition identification.

9. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. "Replace " is authorized by the MAC and assigned maintenance level is shown as the third position code of the Source, Maintenance and Recoverability (SMR) code.

MAINTENANCE ALLOCATION CHART

Table 1. MAC FOR EXPANSIBLE VAN MODEL M1087A1 ECU

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field			Sustainment			
			Unit		Direct Support	General Support	Depot		
			C	O	F	H	D		
5200	EX-VAN AIR CONDITIONER	Replace			2.50			2	
5200	EX-VAN AIR DRYER AND SIGHT GLASS	Replace			0.50			2,3	
5200	EX-VAN BYPASS VALVE	Replace			0.50			2,3	
5200	EX-VAN BYPASS VALVE SOLENOID	Replace			0.50			1,2,3	
5200	EX-VAN EXPANSION VALVE	Replace			1.00			2,3	
5200	EX-VAN COMPRESSOR	Replace			1.50			2,3	
5200	EX-VAN LOW PRESSURE SWITCH	Replace			0.50			1,2	
5200	EX-VAN HIGH PRESSURE SWITCH	Replace			0.50			1,2	
5200	EX-VAN FAN CYCLE SWITCH	Replace			0.50			1,2	
5200	EX-VAN EVAPORATOR FREEZE THERMOSTAT	Replace			0.33			1,2	
5200	EX-VAN FAN BLOWER MOTOR	Replace			0.66			1,2	
5200	EX-VAN HEATER AND OVER-TEMP SWITCH	Replace			0.66			2	
5200	EX-VAN CONTACTOR	Replace			0.75			2	
5200	EX-VAN CAPACITORS AND BRACKET	Replace			0.33			2	
5200	EX-VAN TRANSFORMER	Replace			0.50			2	
5200	EX-VAN RELAYS	Replace			0.50			2	
5200	EX-VAN CIRCUIT BREAKERS	Replace			0.33			2	

MAINTENANCE ALLOCATION CHART - Continued

Table 1. MAC FOR EXPANSIBLE VAN MODEL M1087A1 ECU

(1) Group Number	(2) Component/ Assembly	(3) Maintenance Function	(4) Maintenance Level					(5) Tools and Equipment Ref Code	(6) Remarks Code
			Field			Sustainment			
			Unit		Direct Support	General Support	Depot		
			C	O	F	H	D		
5200	EX-VAN REMOTE CONTROL BOX	Replace			1.00			1,2	
5200	EX-VAN AIR CONDITIONER MOTOR	Replace			1.15			1,2	
5200	EX-VAN PHASE MONITOR	Replace			0.33			2	
5200	EX-VAN PANEL(S)	Replace			0.33			2	

Table 2 Common Tools, Special Tools, and Test Equipment for Expansible Van Model M1087A1 ECU

Tool/Test Equipment	Maintenance Level	Nomenclature	National Stock Number	Tool Number
1	O	Tool Kit, Electrical Contact	5180-00-876-9336	7550526
2	O	Tool Kit, General Mechanics	5180-01-454-3787	5180-95-B47
3	O	Tool Kit, Refrigeration	5180-00-596-1474	SC 5180-95-N18
4	O	Bench Test Cable	TBD	P/N 108-00017-30
5	O	Sling, Endless	3940-00-675-5003	PD101-96
6	O	Multimeter	6625-01-368-0842	73
7	O	Lead, Test	6625-01-335-3088	TL220

Table 3 Remarks for Expansible Van Model M1087A1 ECU

Remarks Code	Remarks
A	2 Level Shop Set 4910-95-A81 replaces 3 Level Maintenance Shop Sets 4910-95-A72, 4910-95-A73, and 4910-94-A74.
B	2 Level Genl Mech Tool Kit SC5180-95-B47 replaces 3 Level Genl Mech Tool Kit SC 5180-90-CL-N26

END OF WORK PACKAGE

CHAPTER 13

EXPENDABLE DURABLES

INTRODUCTION

Scope

This work package lists expendable and durable items that you will need to operate and maintain the LHS trailers. This listing is for information only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, Expendable/Durable Items (except Medical, Class V Repair Parts, and Heraldic Items), or CTA 50-909, Field and Garrison Furnishings and Equipment, or CAT 8-100, Army Medical Department Expendable/Durable Items.

Explanation of Columns in the Expendable/Durable Items List

Column (1) -- Item Number. This number is assigned to each entry in the list and is referenced in the narrative instructions to identify the item.

Column (2) -- Level. This column identifies the lowest level of maintenance that requires the listed item (C = Operator/Crew, O = Field, F = Sustainment).

Column (3) -- National Stock Number (NSN). This is the NSN assigned to the item; us it to requisition the item.

Column (4) -- Item Name, Description, Part Number/(CAGEC). This column provides the other information you need to identify the item. The last line below the description is the part number and Commercial and Government Entity Code (CAGEC) (in parentheses).

Column (5) -- Unit of Issue (U/I). This code shows the physical measurement or count of an item, such as gallon, dozen, gross, etc.

EXPENDABLE AND DURABLE ITEMS LIST

Table 1. Expendable and Durable Items List

(1) Item No.	(2) Level	(3) National Stock Number (NSN)	(4) Item Name, Description, Part Number/(CAGEC)	(5) U/I
1	O	8040-00-117-8510	Adhesive .105-104-9001 (70210)	TU
2	O	8030-01-435-3473	Adhesive M4614611AWN (81349)	TU
3	O	5640-00-906-0936	Cork Tape 4476J1 (39428)	RL
4	O	7520-01-209-1152	Dispenser, Pressure Sensitive Adhesive Tape STD-0-9 (75037)	EA
5	O	8030-00-204-9149	Sealing Compound 392050 (61603)	TU

END OF WORK PACKAGE

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is OAASA	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE Date you filled out this form
TO: *(Forward to proponent of publication or form) (Include ZIP Code)*	FROM: *(Activity and location) (Include ZIP Code)* Enter your mailing address	

PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
	Publication Date	Publication Title

ITEM	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON
10	15-33 19-6	15-7 19-2		4		Item 10. Change Illustration. Reason: Text calls out 90-degree fitting. Art shows straight fitting. Text is correct. Step (4) of removal says to disconnect four hydraulic hoses from manifold. The correct number of hydraulic hoses is five. correct the text to reflect the actual quantity of hydraulic hoses. The supporting illustration is correct.

** Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
Your title	Your telephone number	Your signature

TO: *(Forward direct to addressee listed in publication)*	FROM: *(Activity and location) (Include ZIP Code)*	DATE
	Enter your mailing address	Date you filled out this form.

PART II - REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE
	Publication Date	Your Title

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III - REMARKS *(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
Your title	Your telephone number	Your signature

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is OAASA	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE
TO: *(Forward to proponent of publication or form) (Include ZIP Code)*	**FROM:** *(Activity and location) (Include ZIP Code)*	

PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE

ITEM	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON

** Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

TO: *(Forward direct to addressee listed in publication)*	**FROM:** *(Activity and location) (Include ZIP Code)*	**DATE**

PART II - REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III - REMARKS *(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is OAASA	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE
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PUBLICATION/FORM NUMBER	DATE	TITLE

ITEM	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON

** Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

TO: *(Forward direct to addressee listed in publication)*	**FROM:** *(Activity and location) (Include ZIP Code)*	**DATE**

PART II - REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III - REMARKS *(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

By Order of the Secretary of the Army:

GEORGE W. CASEY, JR.
General, United States Army
Chief of Staff

Official:

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army
0731701

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 256948 requirements for TM 9-4120-451-13&P.

The Metric System and Equivalents

Linear Measure

1 centimeter - 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centrigram = 1.54 grains
1 gram = 10 decigrams = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram - 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Sqaure Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Mulitply by*	*To change*	*To*	*Mulitply by*
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	sqaure inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	millitliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pounds-inches	newton meters	.11296			

Temperature (Exact)

° F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	° C

PIN: 084518-000