



**SERVICE MANUALS**

**FOR**

**MACH 8**

**ROOF TOP HEAT PUMPS**

**Airxcel, Inc.**  
**RV Products Division**  
**P.O. Box 4020**  
**Wichita, KS 67204**

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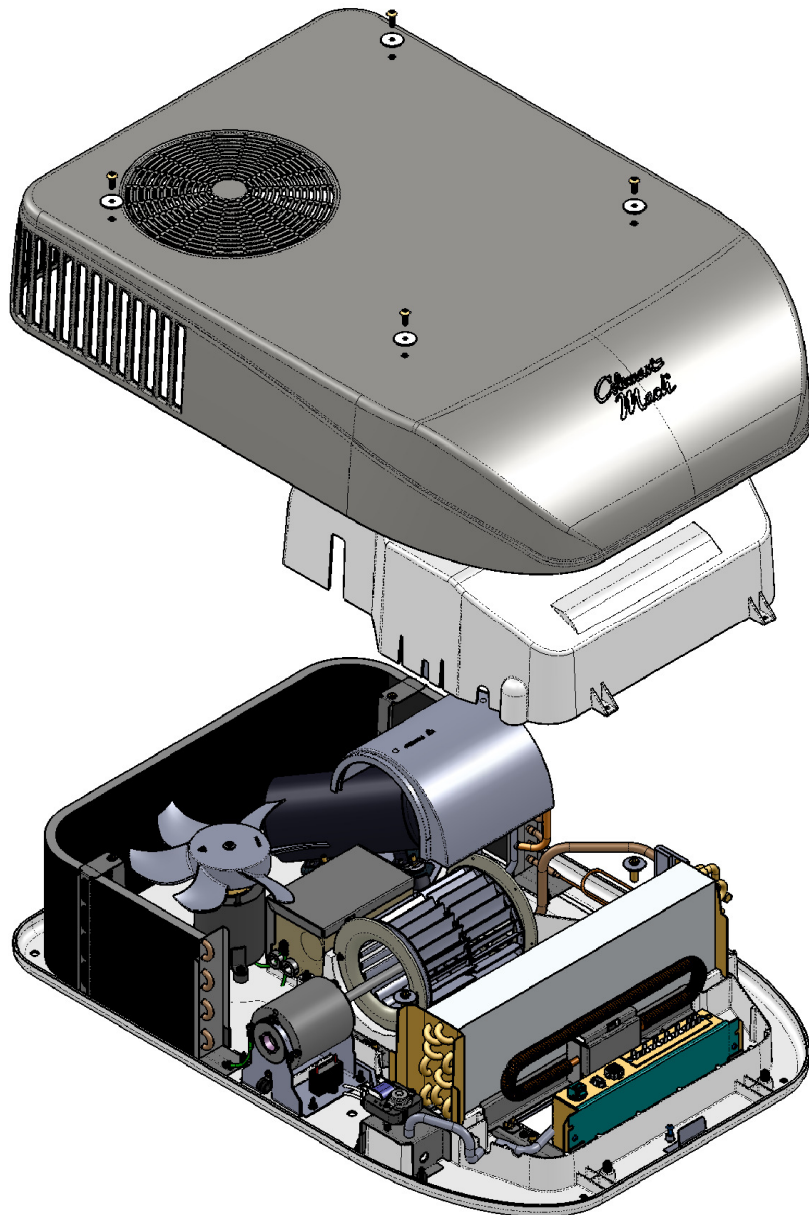
## TABLE OF CONTENTS

<b>I.</b>	<b>The Heat Pump Refrigeration Cycle .....</b>	<b>3</b>
<b>II.</b>	<b>Warnings .....</b>	<b>4</b>
<b>III.</b>	<b>Basic Components and Their Functions .....</b>	<b>4</b>
<b>IV.</b>	<b>Individual Electrical Component Checkouts .....</b>	<b>4</b>
<b>V.</b>	<b>Service Problems and Possible Solutions .....</b>	<b>6</b>
<b>VI.</b>	<b>Wiring Diagram .....</b>	<b>7</b>
<b>VII.</b>	<b>12 VDC Thermostat Color Codes .....</b>	<b>8</b>
<b>VIII.</b>	<b>Mach 8 Heat Pump Wiring Diagram .....</b>	<b>8</b>

## I. THE HEAT PUMP REFRIGERATION CYCLE

The Heat Pump is a refrigeration system like any other refrigeration system in that heat transfers from one place to another. For summer cooling, it can remove heat from occupied areas and transfer the heat to the outside air. When heat is needed, it reverses the action with a reversing valve and will remove heat from the outside air

source and supply heat to the occupied area. We re-label the coils as indoor and outdoor as they are now dual purpose, depending on the usage desired. The outdoor coil is the condenser in the cooling cycle and the evaporator coil in the heating cycle. The indoor coil is the evaporator coil in the cooling cycle and the condenser coil in the heating cycle.



## II. WARNINGS

### IMPORTANT NOTICE

These instructions are for the use of qualified individuals specially trained and experienced in installation of this type equipment and related system components.

Installation and service personnel are required by some states to be licensed. **PERSONS NOT QUALIFIED SHALL NOT SERVICE THIS EQUIPMENT.**

## III. BASIC COMPONENTS AND THEIR FUNCTIONS

### Compressor

The compressor is called a hermetic compressor which means it is completely sealed (welded together). It is, therefore, not internally field serviceable. Inside the compressor housing is basically an electric motor which drives the compressor.

### Reversing Valve

The reversing valve's main function is to reverse the flow of refrigerant. Internally, it is composed of two pistons on a sliding block or cylinder with two openings. The operation of the piston block is controlled by a solenoid valve. The solenoid valve controls the flow of the refrigerant, which produces a pressure difference in the valve itself. When the solenoid valve is energized, it is in the heating mode. When it is de-energized, it is in the cooling mode.

### Outdoor Coil (Cooling Mode)

The purpose of the finned condenser coil is to transfer heat from the high pressure refrigerant to the warm outdoor air. As the outdoor air passes over the coil, the

heat transfer will cause the air temperature to rise. Thus the condenser discharge air will be several degrees warmer than the condenser entering air.

### By-Flow Restrictor

The by-flow restrictor is the metering device for the heat pump. The restrictor is made up of two orifices positioned back to back. There is a space between the orifices. As the system is either in the cooling or heating mode, it forces one of the orifices to seat at one of the tapered ends and forces the other to break its seal. Refrigerant goes around one orifice and through the other, establishing the pressure drop. The orifices are different sizes to accommodate for the difference in the condenser and evaporator sizes.

### Indoor Coil (Cooling Mode)

The purpose of the finned evaporator coil is to transfer the heat from the warm and moist indoor air to the cold low pressure refrigerant.

## IV. INDIVIDUAL ELECTRICAL COMPONENT CHECKOUTS

### WARNING

**CAREFULLY FOLLOW ALL INSTRUCTIONS AND WARNINGS IN THIS BOOKLET TO AVOID DAMAGE TO THE EQUIPMENT, PERSONAL INJURY OR FIRE.**

### Overload Switch

The switch is connected in series with common so if the switch opens, it will cut the power to the compressor motor. The switch will open as the result of either or both of two conditions that could be harmful to the compressor.

#### a) High Amperes (Current)

The switch contains a heater which increases in temperature as the current increases. The higher temperature warps the switch and will cause it to open before the windings reach a dangerous temperature.

#### b) High Temperature (Thermal)

The switch is clamped tightly against the compressor housing and located close to the windings. Therefore, as the windings reach a higher temperature, it takes less current to cause the switch to open.

As can be seen, the switch is always affected by a combination of current to the compressor and winding temperature.

### Fan Motors

The heat pump unit has **two** fan motors. On one motor is mounted a centrifugal or squirrel cage blower which draws air (return air) out of the recreational vehicle and blows the conditioned air down into the recreational vehicle. On the other motor is mounted an axial flow or propeller type fan which circulates outdoor air through the condenser coil.

An important step in installing a replacement fan motor is to check the direction of rotation before it is installed. On all models, the condenser fan pulls the air through the coil.

### Fan Motor Check Procedure

If a fan motor refuses to perform properly, it can be checked in the following manner:

1. Be sure the motor leads are connected to the proper points –
  - a) The black wire from the motor connects to a black wire inside a wire nut then the black wire connects through the disconnect plug to the selector switch. The red wire from the motor connects to a red wire in a wire nut, then the red wire connects through the disconnect plug to the selector switch.
  - b) The white wire from the motor connects to a white wire in a wire nut then the white wire connects through the disconnect plug to the thermostat.
  - c) The brown wires from the motor connect to the fan capacitor.

### Selector Switch – Free Delivery Ceiling Assemblies

The selector switch is mounted on the left side of the interior ceiling assembly. Check for continuity between the terminals with an ohm meter.

<u>Switch Position</u>	<u>Continuity</u>
HEAT	L-1-3
LO FAN	L-1
HI FAN	L-2
LO COOL	L-1-4
HI COOL	L-2-4

### Thermostat (Mechanical Rotary)

The thermostat (temperature controller) is mounted on the right side of the interior ceiling assembly. The thermostat controls the on-off cycle of the compressor when the selector switch is in the cooling position, and the on-off cycle of the heat pump or electric heater when the selector switch is in the heating position. The thermostat is actuated by sensing the temperature of the return air through the vent where the bulb is located. Check continuity between terminals with an ohm meter.

### Heating Element

The heating element is a resistance heater of 6000 BTU capacity and is connected across the line when the selector is set for heating and the thermostat is calling for heat. The current draw of the heater (element only) will be 15.2 amperes at 120 volts (domestic USA models).

### Limit Switch (Heating Element)

The limit switch is a safety switch and is mounted in the heating element frame. It will open and break the circuit on temperature rise in case the air flow through the heater becomes low enough to cause the heater to overheat. Limit switch may be checked for continuity with an ohm meter.

### Run Capacitors

The purpose of the run capacitors is to improve motor efficiency during running. The run capacitors are always connected between the start and run or main terminals of the motor.

### Start Capacitor

Most models use a start capacitor and a PTCR to give the compressor high starting torque. The compressor will, therefore, start against normal pressure difference (head pressure minus suction pressure) even when shut down for a short period of time. The start relay will disconnect the start capacitor when the motor reaches approximately 75% running speed.

### Thermistor

The thermistor is a freeze protection device installed in the compressor relay circuit to prevent evaporator coil freeze-ups. This device is a semi-conductor which has electrical resistance that varies with temperature. The thermistor cutout temperature is 26 degrees F ( $\pm 3$  degrees) and reset temperature is 40 degrees F ( $\pm 3$  degrees).

**Freeze Switch**

The freeze switch is a normally closed switch wired in series with compressor common wire.

The freeze switch, located on the condenser coil, opens at 18 degrees F (±6 degrees) actual coil temperature, not ambient temperature. When this switch opens, the compressor shuts off.

**V. SERVICE PROBLEMS WITH THE HEAT PUMP STANDARD CEILING ASSEMBLIES**

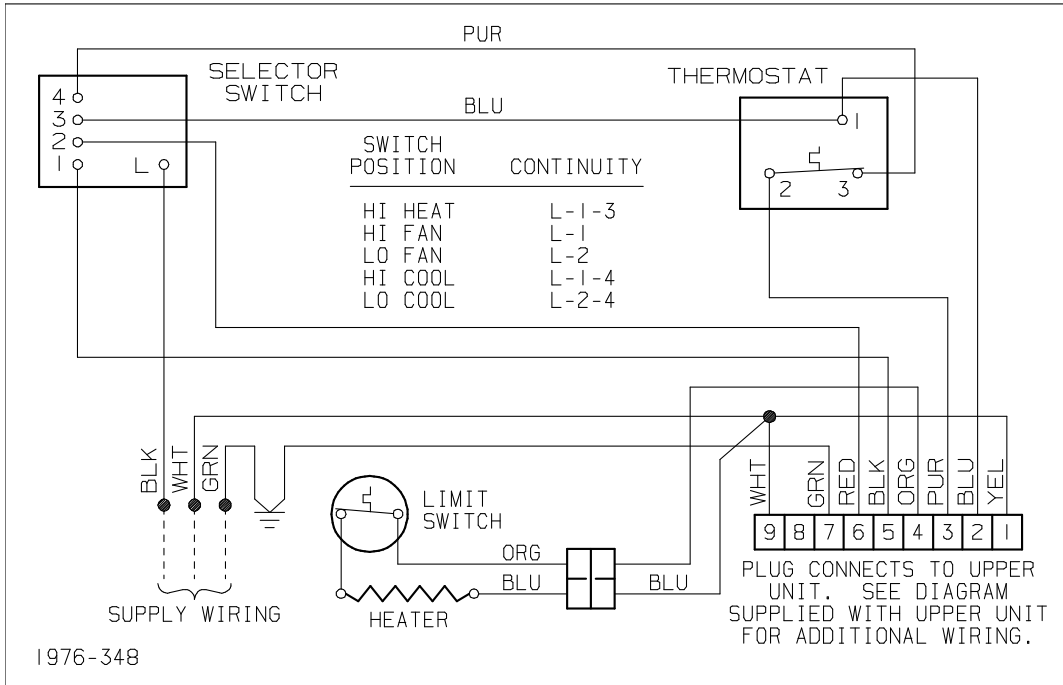
The following list of service problems covers only some of the more common problems which may occur and lists only the more probably causes.

In many instances, it will be necessary to use the wiring diagram in this guide to check out the electrical circuits step by step, starting at the power source.

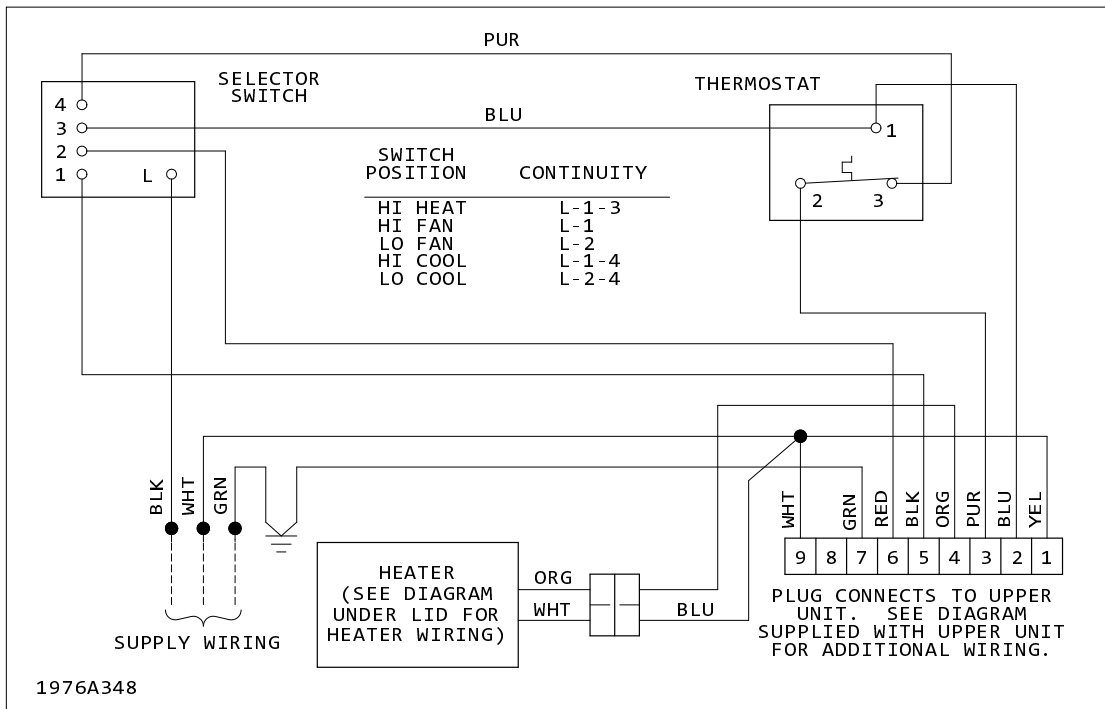
PROBLEMS	POSSIBLE CAUSES (REFER TO THE INDIVIDUAL COMPONENT CHECKOUT PROCEDURES)
Nothing Runs, No Compressor, No Fan, No Heat	No Heat Pump Voltage, Selector Switch
Fan Runs, No Compressor Operation In The Cooling Mode	Insufficient Voltage To The Unit, Wiring, Thermostat, Start Capacitor, Run Capacitor, Start Relay, Open Overload, Selector Switch, Compressor
Fan Runs, No Compressor Operation In The Heat Pump Mode	Insufficient Voltage To The Unit, Wiring, Thermostat, Selector Switch, Start Capacitor, Run Capacitor, Start Relay, Open Overload, Freeze Switch Opened, Compressor
Heat Or Compressor Runs, No Fan Operation	Wiring, Selector Switch, Fan Capacitor, Fan Motor
Fan Runs, No Electric Heat Element, Heat Pump Runs	Wiring, Thermostat, Selector Switch, Limit Switch, Freeze Switch, Heating Element
Fan Runs, Compressor Runs, No Heat If Unit Is Cooling In The Heat Pump Mode	Wiring, Selector Switch, Reversing Valve Solenoid
Compressor Runs, Fan Runs, Insufficient Heat	Air Flow Restrictions, Freeze Switch May Open Due To Low Ambient Temperature, (Undersized) Too Much Heat Loss In The Vehicle, Refrigeration System, Very Little Or No Refrigerant Charge, Compressor
Compressor Runs, Fan Runs, Insufficient Cooling	Air Flow Restrictions, High Ambient Temperature, (Undersized) Too Much Heat Gain To The Vehicle, Refrigeration System, Very Little Or No Refrigerant Charge, Compressor <b>(IF YOU HAVE NOT BEEN PROPERLY TRAINED IN REFRIGERATION SEALED SYSTEM REPAIRS, DO NOT ATTEMPT TO BREAK INTO THE SYSTEM.)</b>

# VI. WIRING DIAGRAM

## 9530X715 FREE DELIVERY HEAT PUMP FREE DELIVERY HEAT PUMP CEILING ASSEMBLY 120 VAC



## 9530F715, 9530G715



## VII. LOW VOLTAGE WIRING

Thermostat Terminal	Mate With	Control and Supply Wiring	Ceiling Assembly Terminal
R or Red		One Red, +12 VDC Supply Wire to Thermostat	N/A
B or Blue		-12 VDC Supply Wire to Thermostat and One Other Wire to Ceiling Assembly/Plenum	B
Y or Yellow		Compressor Control Wire to Ceiling Assembly/Plenum	Y
GH or Green		Hi Fan Control Wire to Ceiling Assembly/Plenum	GH
GL or Gray		Lo Fan Control Wire to Ceiling Assembly/Plenum	GL
W or White (N/A on Cool Only Models)		Engages White Wire of Sub-Base (From Thermostat)	Thermostat Sub-Base (Electric or Gas Heat)
Thermostat Operations		Internal 12 VDC Connections Made	
Low Cooling		Red to Yellow and Gray	
High Cooling		Red to Yellow and Green	
High Heat		Red to White	
Fan Only (Hi Fan)		Red to Green	

## VIII. MACH 8 HEAT PUMP WIRING DIAGRAM

