Carrier
Transicold

Transport
Air Conditioning

68G5-105 SERIES
MCI J4500 COACH

Carrier

Operation & Service

T-312 Rev-

Carrier
TRANSICOLD

OPERATION AND SERVICE MANUAL

TRANSPORT
AIR CONDITIONING
EQUIPMENT

Model 68G5-105 Series
for
MCI J4500 Model Coach

Carrier Transport Refrigeration and Air Conditioning,
A member of the United Technologies Corporation family. Stock symbol UTX.
Carrier Transicold, Carrier Corporation, P.O. Box 4805, Syracuse, N.Y. 13221 U. S. A.

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SAFETY SUMMARY

GENERAL SAFETY NOTICES

The following general safety notices supplement the specific warnings and cautions appearing elsewhere in this manual. They are recommended precautions that must be understood and applied during operation and maintenance of the equipment covered herein. The general safety notices are presented in the following three sections labeled: First Aid, Operating Precautions and Maintenance Precautions. A listing of the specific warnings and cautions appearing elsewhere in the manual follows the general safety notices.

FIRST AID

An injury, no matter how slight, should never go unattended. Always obtain first aid or medical attention immediately.

OPERATING PRECAUTIONS

Always wear safety glasses.

Keep hands, clothing and tools clear of the evaporator and condenser fans.

No work should be performed on the unit until all circuit breakers and start-stop switches are turned off, and power supply is disconnected.

Always work in pairs. Never work on the equipment alone.

In case of severe vibration or unusual noise, stop the unit and investigate.

MAINTENANCE PRECAUTIONS

Beware of unannounced starting of the evaporator and condenser fans. Do not open the condenser fan grille or evaporator access panels before turning the power off, and securing the power source.

Be sure power is turned off before working on motors, controllers, solenoid valves and electrical control switches. Tag circuit breaker and power supply to prevent accidental energizing of circuit.

Do not bypass any electrical safety devices, e.g. bridging an overload, or using any sort of jumper wires. Problems with the system should be diagnosed, and any necessary repairs performed, by qualified service personnel.

When performing any arc welding on the unit, disconnect all wire harness connectors from the modules in the control box. Do not remove wire harness from the modules unless you are grounded to the unit frame with a static-safe wrist strap.

In case of electrical fire, open circuit switch and extinguish with CO_2 (never use water).

SPECIFIC WARNINGS AND CAUTIONS

WARNING

BE SURE TO OBSERVE WARNINGS LISTED IN THE SAFETY SUMMARY IN THE FRONT OF THIS MANUAL BEFORE PERFORMING MAINTENANCE ON THE HVAC SYSTEM

WARNING

DO NOT USE A NITROGEN CYLINDER WITHOUT A PRESSURE REGULATOR

WARNING

DO NOT USE OXYGEN IN OR NEAR A REFRIGERATION SYSTEM AS AN EXPLOSION MAY OCCUR.

WARNING

EXTREME CARE MUST BE TAKEN TO ENSURE THAT ALL THE REFRIGERANT HAS BEEN REMOVED FROM THE COMPRESSOR CRANKCASE OR THE RESULTANT PRESSURE WILL FORCIBLY DISCHARGE COMPRESSOR OIL.

WARNING

WHEN MOVING THE COIL CARE MUST BE TAKEN TO AVOID PERSONAL INJURY BECAUSE OF THE WEIGHT OF THE COIL.

CAUTION

Do not under any circumstances attempt to service the microprocessor. Should a problem develop with the microprocessor, replace it.

CAUTION

Care Must Be Taken To Ensure That The Manifold Common Connection Remains Immersed In Oil At All Times Or Air And Moisture Will Be Drawn Into The System.

CAUTION

To prevent trapping liquid refrigerant in the manifold gauge set be sure set is brought to suction pressure before disconnecting.

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SECTION 1

DESCRIPTION

1.1 INTRODUCTION

This manual contains Operating and Service Instructions and Electrical Data for the Model 68G5-105 Coach Air Conditioning and Heating equipment furnished by Carrier Transicold Division for the MCI J-Series Intercity coach. Table 1-1 provides a model number chart.

The Model 68G5-105 equipment (see Figure 1-1) consist of a condenser, a main evaporator with integral heater, a driver evaporator with integral heater, optional parcel rack evaporators, compressor assembly, main control box, driver display panel, check valve assembly, temperature sensors and a bypass heat valve.

The 68G5 air conditioning and heating equipment interfaces with electrical cabling, a parcel rack evaporator thermostat kit, refrigerant piping, engine coolant piping, ductwork and other components furnished by the coach manufacturer to complete the system.

Table 1-1. Part (Model) Number Chart

Model No.	Refrigerant	Controller	Fan Motors	Parcel Rack Connection
68G5-105	R-134a	Microprocessor	24VDC	Yes

Table 1-2. Additional Support Manuals

MANUAL/FORM NUMBER	EQUIPMENT COVERED	TYPE OF MANUAL
62-02756	O5G Compressor	Operation and Service
T-200PL	O5G Compressor	Parts List
T-279PL	MCI E/J Coach	Parts List

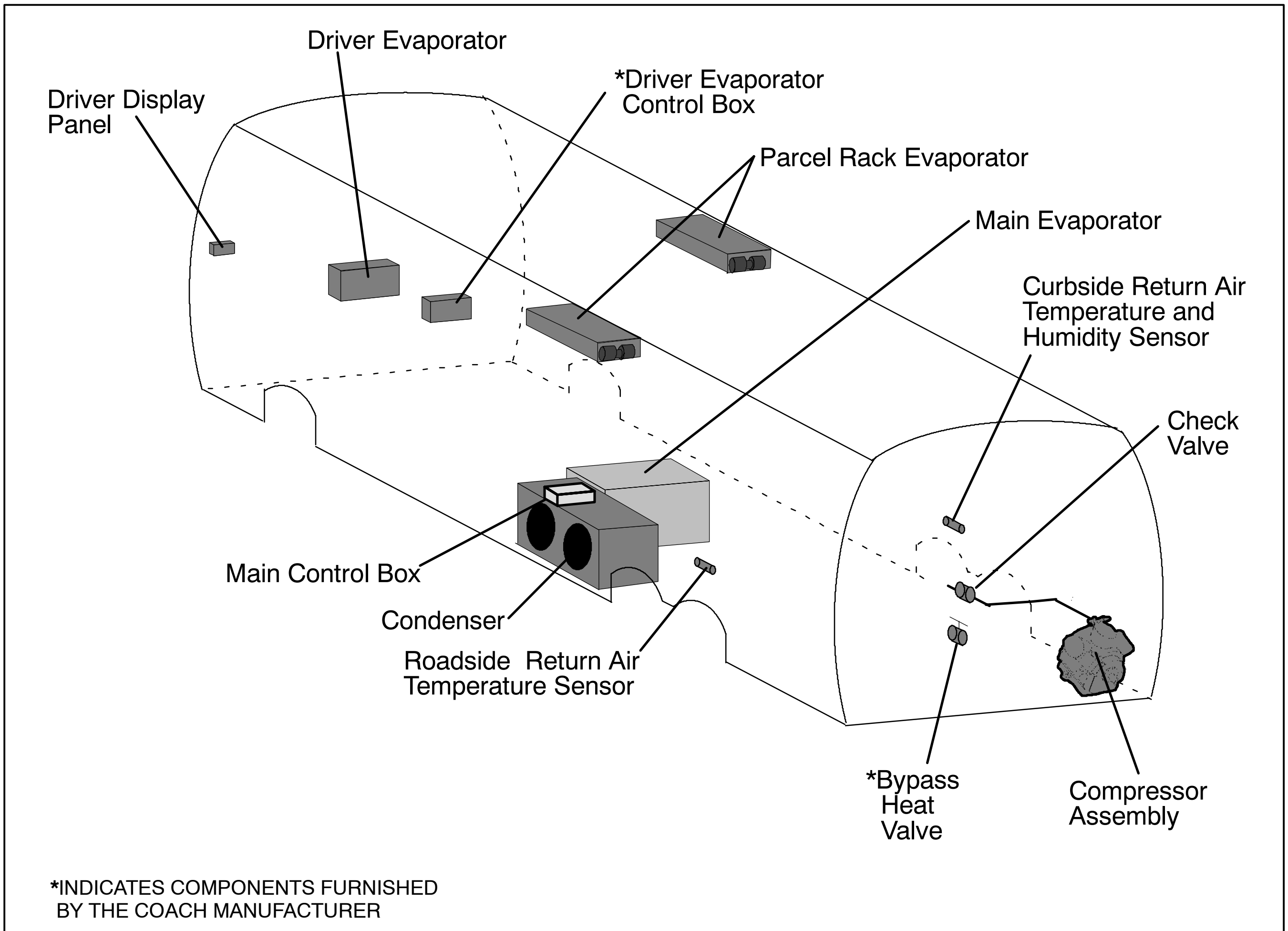


Figure 1-1. Coach Cutaway View

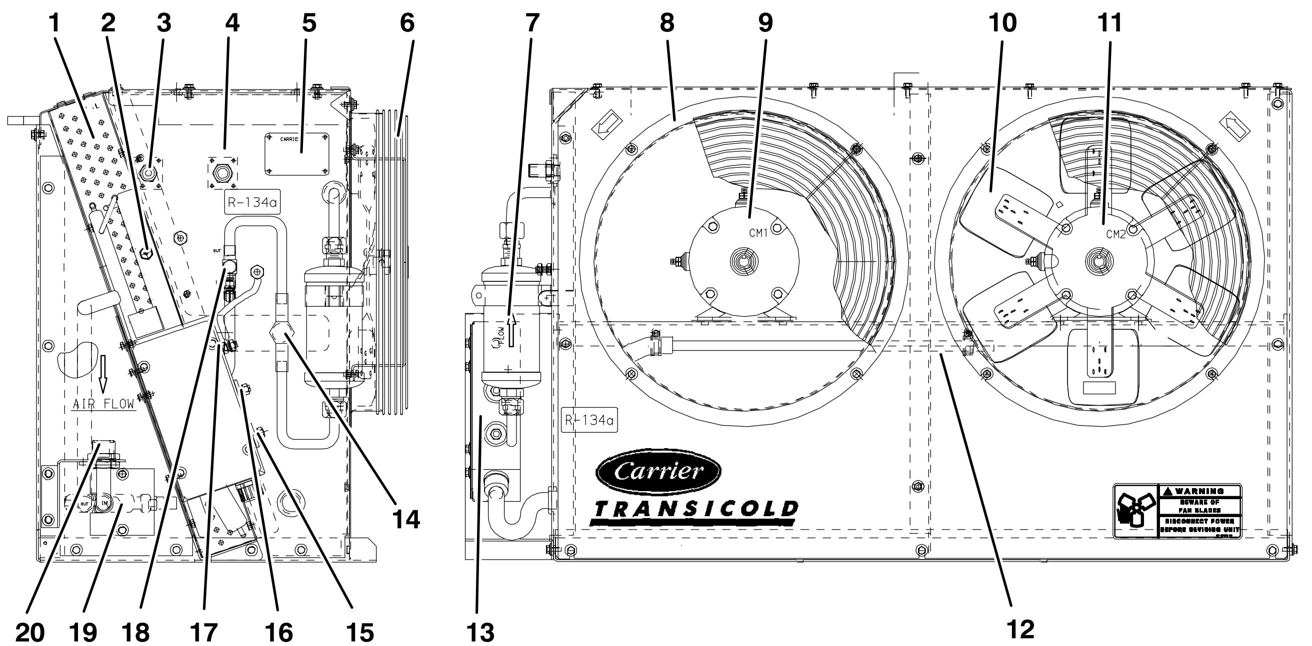
1.2 GENERAL DESCRIPTION

1.2.1 Condenser Assembly

The condenser assembly (See Figure 1-2) includes a condenser coil, fan and motor assemblies, filter-drier, sight glass, control box, liquid line solenoid valve(s), king valves and an ambient temperature sensor.

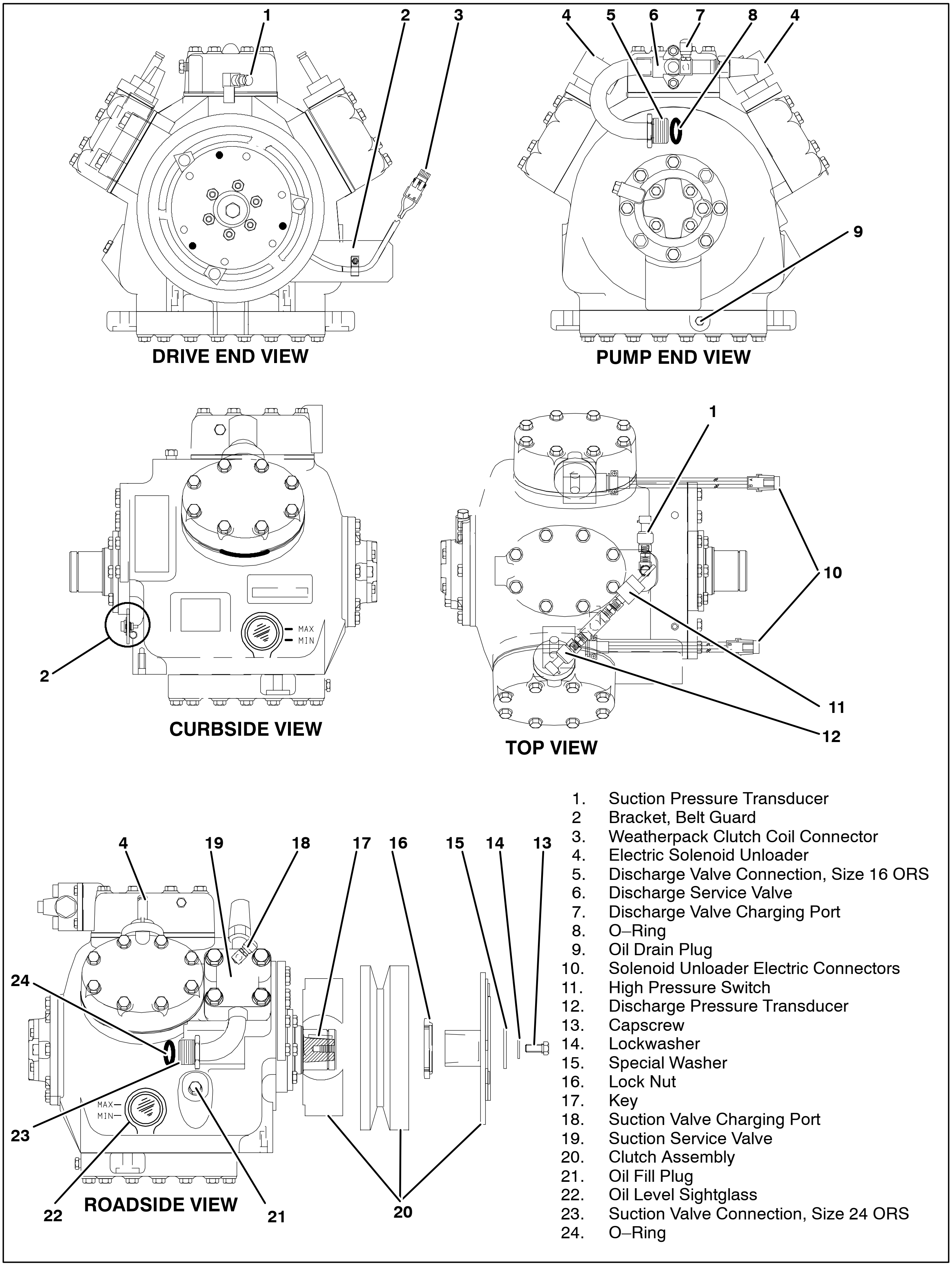
The condenser coil provides a heat transfer surface for condensing refrigerant gas at a high temperature and pressure into a liquid at high temperature and pressure. The condenser fans circulate ambient air across the outside of the condenser tubes at a temperature lower than refrigerant circulating inside the tubes; this results in condensing the refrigerant into a liquid. The filter-drier removes moisture and other noncondensibles from the liquid refrigerant before it enters the thermal expansion valves in the evaporator assemblies.

The condenser is also fitted with a fusible plug which protects the system from unsafe high temperatures. The control box includes condenser fan relays no. 1 and no. 2 (CFR1 and CFR2) to enable the main controller to control operation of condenser fan motors no. 1 and no. 2 (CM1 and CM2). The control box also includes condenser speed relay no. 1 (CSR1) which controls the speed of both condenser fan motors CM1 and CM2. The main evaporator liquid line solenoid valve and the parcel rack liquid line solenoid valve (when so equipped) closes when the system is shut down to prevent refrigerant migration and to isolate the filter-drier for servicing when the compressor is shut down. The king valves enable servicing of the condenser assembly. The ambient temperature sensor measures ambient temperature and sends an electrical signal to the main controller.



1. Condenser Coil Assembly
2. Fusible Plug
3. Liquid Line Outlet Fitting (Parcel Rack)
4. Liquid Line Outlet Fitting (Main)
5. Model/Serial No. Nameplate
6. Fan Guard
7. Filter-Drier
8. Venturi Ring
9. Condenser Fan Motor CM1
10. Fan Blade
11. Condenser Fan Motor CM2
12. Outside Temperature Sensor
13 Control Box-Contains: Condenser Fan Relay No.1 (CFR1), Condenser Fan Relay No. 2 (CFR2) and Condenser Speed Relay No. 1 (CSR1)
14. Moisture & Liquid Indicator
15. Control Box Positive (+) Stud
16. Control Box Positive (+) Stud
17. Control Box Negative (–) Stud
18 Liquid Line (King) Valve
19. Discharge Shutoff King Valve
20. Refrigerant Inlet Fitting

Figure 1-2. Condenser Assembly



1. Suction Pressure Transducer
2 Bracket, Belt Guard
3. Weatherpack Clutch Coil Connector
4. Electric Solenoid Unloader
5. Discharge Valve Connection, Size 16 ORS
6. Discharge Service Valve
7. Discharge Valve Charging Port
8. O–Ring
9. Oil Drain Plug
10. Solenoid Unloader Electric Connectors
11. High Pressure Switch
12. Discharge Pressure Transducer
13. Capscrew
14. Lockwasher
15. Special Washer
16. Lock Nut
17. Key
18. Suction Valve Charging Port
19. Suction Service Valve
20. Clutch Assembly
21. Oil Fill Plug
22. Oil Level Sightglass
23. Suction Valve Connection, Size 24 ORS
24. O–Ring

Figure 1-3. Compressor Assembly

1.2.2 Compressor Assembly

The compressor assembly (See Figure 1-3.) includes the refrigerant compressor, clutch assembly, suction and discharge service valves, high pressure switch, suction and discharge pressure transducers, suction and discharge servicing (charging) ports and electric solenoid unloaders.

The compressor raises the pressure and temperature of the refrigerant gas and forces it into the condenser tubes. The clutch assembly provides a means of belt driving the compressor by the coach engine. The suction and discharge service valves enable servicing of the compressor. Suction and discharge access (charging) ports mounted on the service valves enable connection of charging hoses for servicing of the compressor, as well as other parts of the refrigerant circuit. Transducers convert refrigerant pressures into electrical signal inputs which are sent to the main controller. The high pressure switch (HPS) is a normally closed switch, its contacts open on a pressure rise to shut down the system when abnormally high refrigerant pressures occur. The electric unloaders provide a means of controlling compressor capacity, which enables control of temperature inside the coach. For more detailed information on the compressor, refer to manual number 62-02756.

1.2.3 Evaporator Assemblies

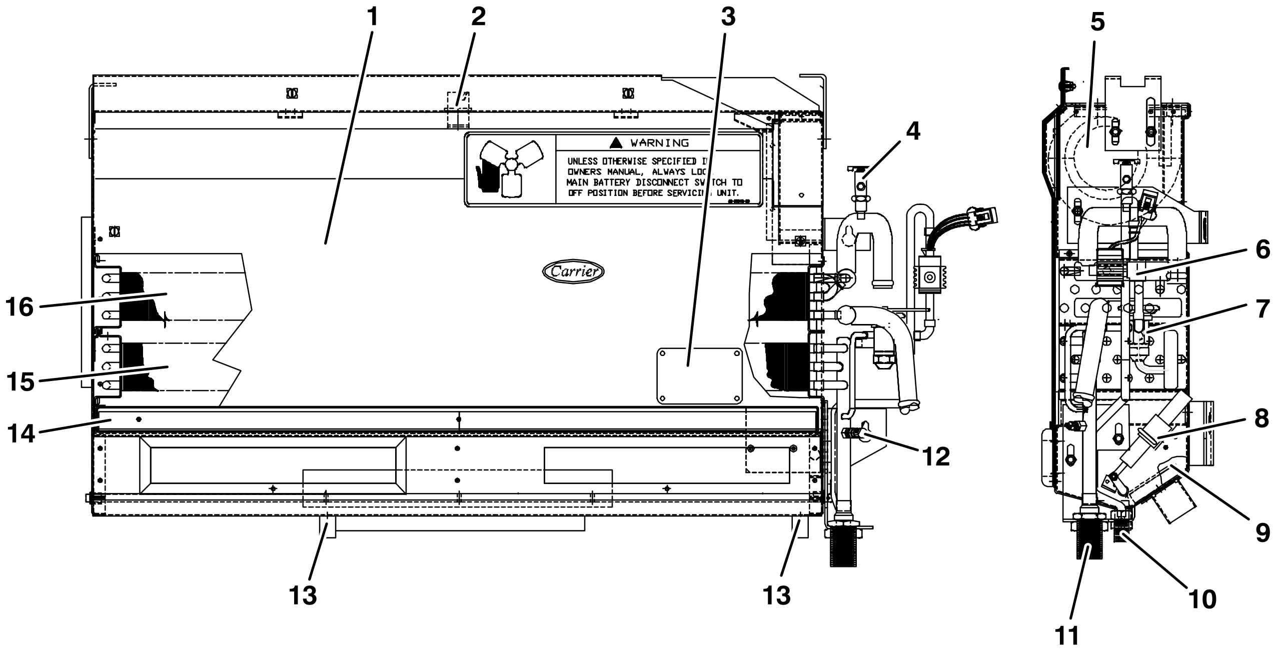
The evaporator assemblies include a driver evaporator assembly (See Figure 1-4), a main evaporator assembly (See Figure 1-6), and may include two parcel rack evaporator assemblies (See Figure 1-5).

The driver evaporator assembly includes an evaporator coil assembly, a thermal expansion valve, a heater coil assembly, an evaporator heat valve (EHV), two fan and motor assemblies, an air filter, and two condensate drain connections. The evaporator heat valve (EHV) for the driver evaporator is installed in the piping outside the evaporator assembly. In addition, the driver evaporator has an actuator, which controls the outside (RAM) air damper upon receipt of signal from the main controller.

The main evaporator assembly includes an evaporator and heater coil assembly, a thermal expansion valve, an evaporator heat valve (EHV), a fan and motor assembly, an air filter, and two condensate drain connections. There is also an evaporator speed fan relay (EFRL), which changes main evaporator fan speed upon receipt of a signal from the main controller.

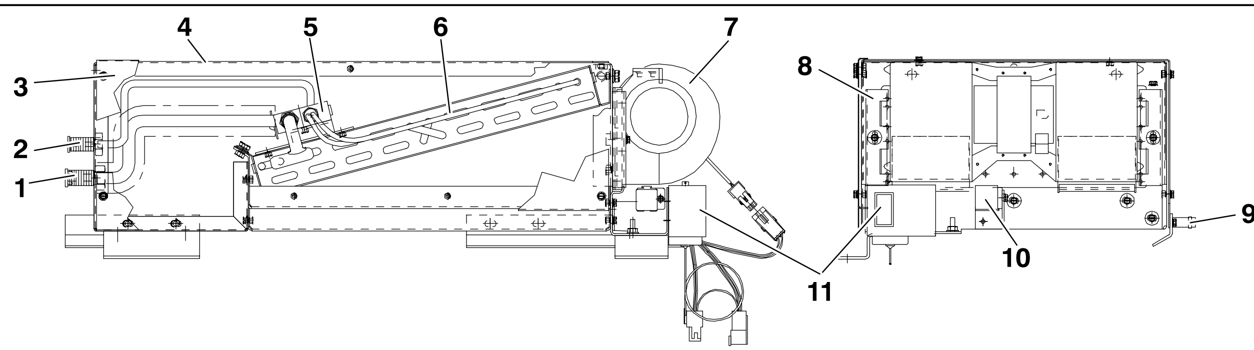
The optional parcel rack evaporator assemblies includes an evaporator coil assembly, a thermal expansion valve, a fan and motor assembly, condensate drain connection, and a return air thermostat (on the road side only).

The evaporator coils provide a heat transfer surface for transferring heat from air circulating over the outside surface of the coil to refrigerant circulating inside the tubes; thus providing cooling when required. The thermal expansion valves meter the flow of refrigerant entering the evaporator coils. The heating coils provide a heat transfer surface for transferring heat from engine coolant circulating inside the tubes to air circulating over the outside surface of the tubes, thus providing heating when required. The evaporator heat valve(s) (EHV) controls the flow of engine coolant supplied to the heating coils. The fans circulate the air over the coils. The air filters filter dirt particles from the air before the air passes over the coils. The condensate drain connections provide a means for disposing of condensate collected on the evaporator coils during cooling operation.



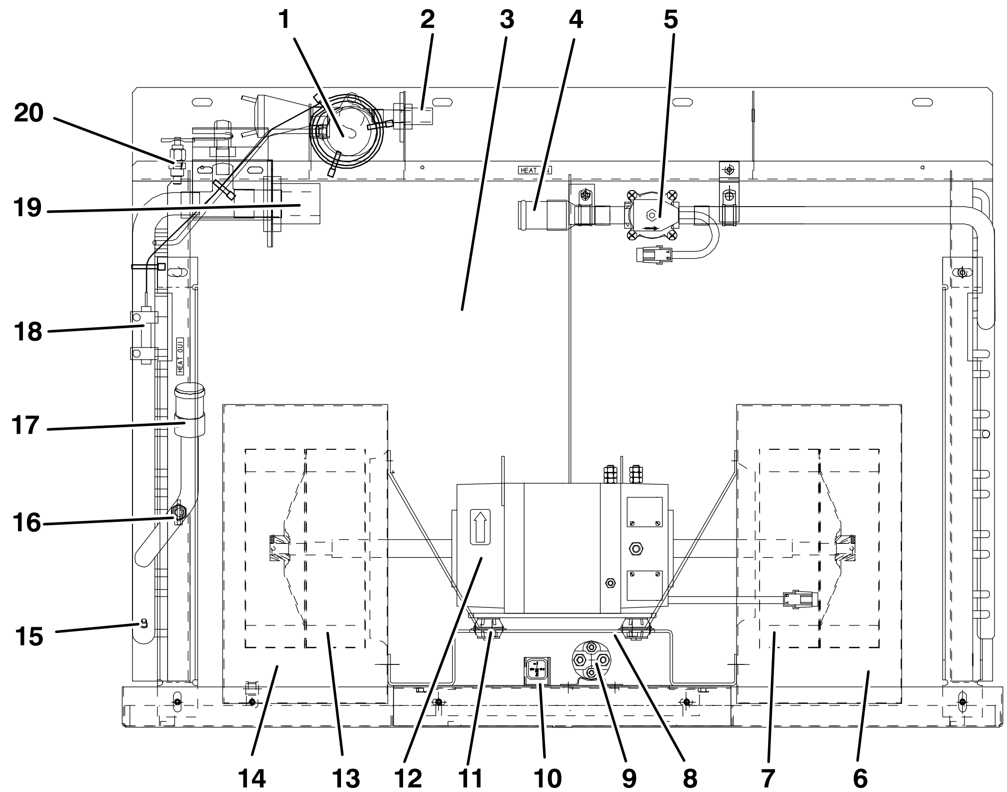
1. Access Panel
2. Electrical Connector
3. Nameplate
4. Air Bleed Valve
5. Fan and Motor
6. Solenoid Valve and Coil
7. Thermal Expansion Valve
8. RAM Actuator
9. RAM Air Door
10. Liquid Inlet Connection, Size 11/16 ORS
11. Suction Outlet Connection, 1-7/16 ORS
12. Service Port
13. Condensate Drain Connections
14. Air Filter
15. Evaporator Coil Assembly
16. Heater Coil Assembly

Figure 1-4. Driver Evaporator Assembly



1. Suction Outlet Connection
2. Liquid Inlet Connection
3. Side Access Panel
4. Top Access Panel
5. Thermal Expansion Valve
6. Evaporator Coil Assembly
7. Fan and Motor
8. Motor Mount Bracket
9 Condensate Drain Connection
10. Relay
11. Thermostat (Not supplied by Carrier)

Figure 1-5. Parcel Rack Evaporator Assembly



1. Thermal Expansion Valve
2. Refrigerant Liquid Inlet Connection, 3/8“ ORS
3. Evaporator/Heater Coil Assembly
4. Heater Coil Inlet Connection, 7/8 OD
5. Evaporator Heat Valve (EHV)
6. Blower Housing, Right
7. Blower Wheel, Right
8. Nameplate
9. Evaporator Fan Relay, High Speed (EFRH)
10. Evaporator Fan Relay, Low Speed (EFRL)
11. Elastomeric Motor Mounts
12. 2-Speed Motor
13. Blower Wheel, Left
14. Blower Housing, Left
15. Service Port
16. Coolant Drain valve
17. Heater Coil Outlet Connection, 7/8 OD
18. Capillary Tube and Bulb (TXV)
19. Refrigerant Suction Outlet Connection, 1” ORS
20. Air Bleed Valve
21. Air Filter Channel

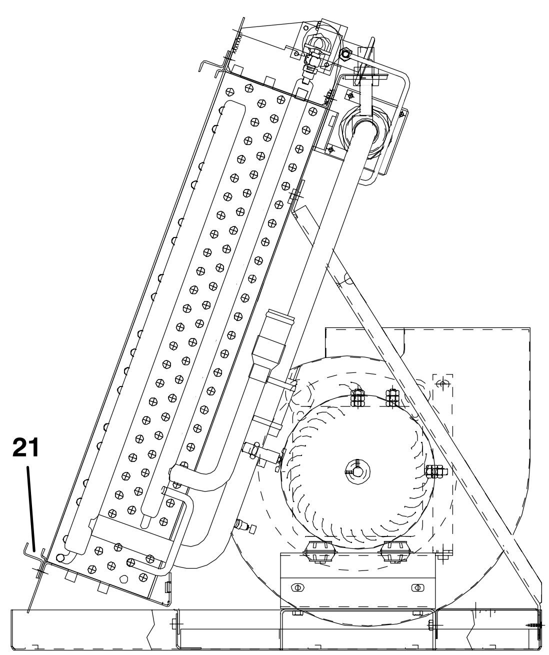
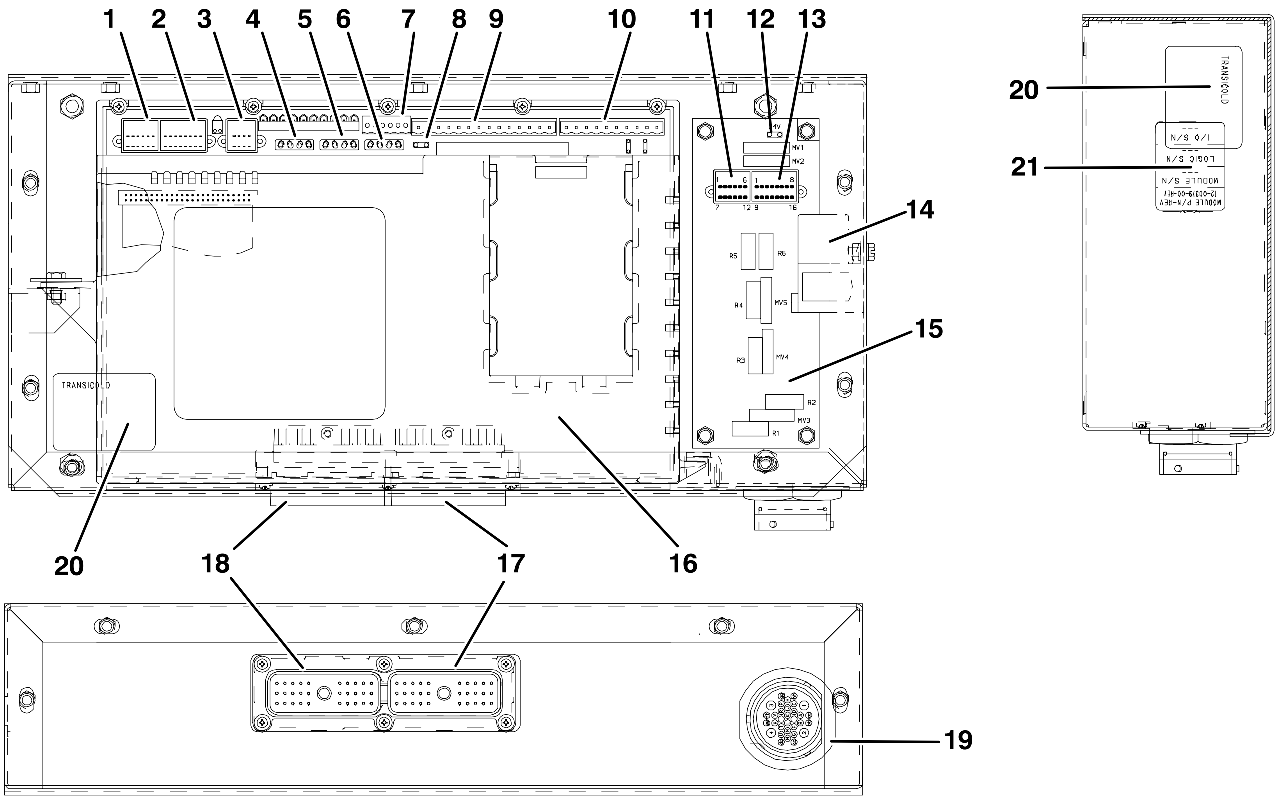


Figure 1-6. Main Evaporator Assembly

1.2.4 Main Control Box

The main control box (See Figure 1-7) includes a main controller (microprocessor module), expansion output board, receptacle, quick connectors, connectors and fuses (F2 and F3). The main controller (microprocessor module) contains the electronic hardware to measure inputs and process the outputs to automatically control the air conditioning and heating system to maintain temperatures inside the coach. The microprocessor section has a built in memory facility for checking proper operation; this includes checks of the program memory, data memory and analog. It has a self test feature which is executed when the system is first powered up. The expansion board drives six discrete outputs in addition to the standard outputs from the controller.



1. Connector (MA)
2. Connector (MB)
3. (Not Used)
4. Fuse (F2)
5. (Not Used)
6. Fuse (F3)
7. (Not Used)
8. Quick Connector (QC1)
9. Connector (KA)
10. Connector (KB)
11. Connector (MA)
12. Quick Connector (QC2)
13. Connector (MB)
14. Relay
15. Expansion Board
16. Main Controller
17. Packard Connector Pins L thru Y
18. Packard Connector Pins A thru K
19. Coach Interface Connector
20. Model/Serial Number Plate (Box)
21. Model/Serial Number Tag (Controller)

Figure 1-7. Main Control Box

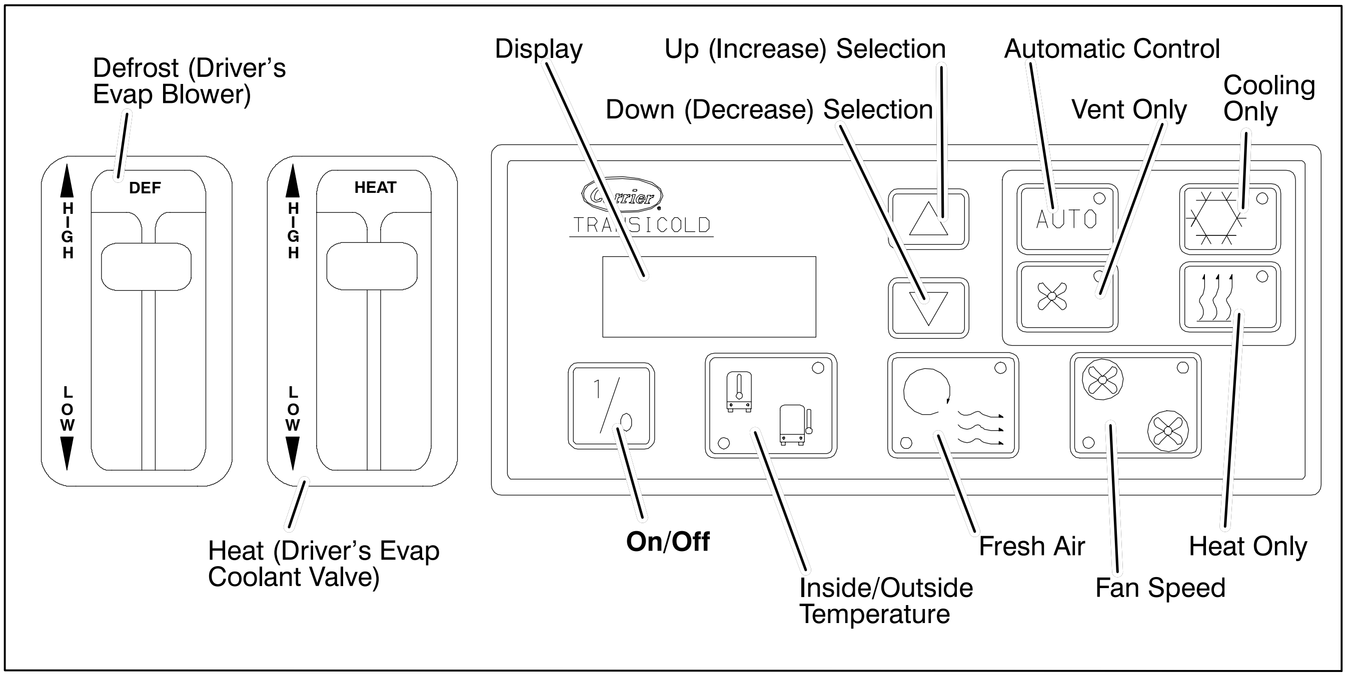


Figure 1-8. System Operating Controls (upper left hand switch panel)

1.2.5 System Operating Controls And Components

There are five controls on the driver's station which affect the operation of the Carrier supplied equipment covered by this manual. These controls include two rocker switches, two slide switches, and the Micromate Control Panel.

The first slide switch is the Defrost Switch (Figure 1-8). This switch controls the driver evaporator blower motor speed. The second slide switch is the Heat Switch (Figure 1-8). This switch controls the driver evaporator coolant valve. These switches are located on the dashboard to the left of the steering wheel.

The third control is the Driver Display Panel (Figure 1-8) which operates the Carrier Transicold microprocessor controller, circuit breakers and relays. Modes of operation include Vent, Heat, Cool and Auto. This control panel is located on the dashboard with the slide switches to the left of the steering wheel.

In the vent mode the evaporator fans are operated to circulate air in the bus interior.

In the heat mode the heat valve and the OEM supplied floor blower and/or boost pump are energized. The evaporator fans operate to circulate air over the evaporator coil and heater coil in the same manner as the vent mode.

In the cooling mode the compressor is energized while the evaporator and condenser fans are operated to provide refrigeration as required. The compressor is fitted with cylinder unloaders to match compressor capacity to the bus requirements. Once the interior temperature reaches the desired set point, the system will maintain compressor operation and open the heat valve to allow reheating of the return air. In the reheat mode interior temperature is maintained at the desired set point while additional dehumidification takes place.

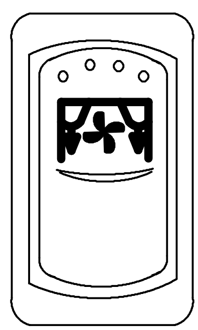


Figure 1-9. Parcel Rack On/Off

The forth control is the rocker switch for the Parcel Rack (Figure 1-9). This switch will de-activate the parcel rack evaporators if the main evaporator is in operation. This switch is located on the dashboard to the right of the steering wheel.

The fifth control is the rocker switch for the Driver A/C (Figure 1-10). It is located on the left side console panel near the transmission gear selector. This switch will activate the system to provide cooling for the driver in the event that cooling is not called for by the Carrier Transicold microprocessor.

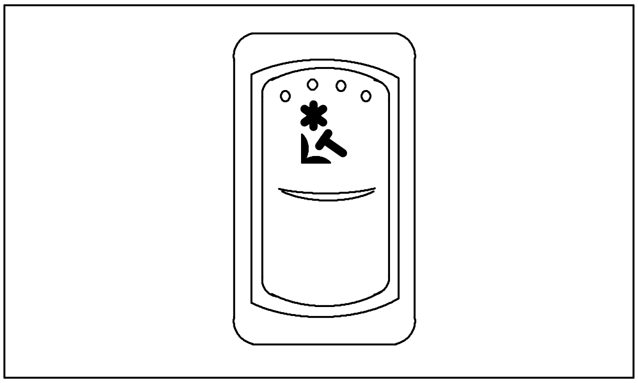


Figure 1-10. Driver A/C

1.2.6 Other Carrier Supplied Items

Other Carrier supplied items include curbside and roadside return air temperature sensors, two coolant control valves and a check valve. The temperature sensors provide input to the controller on temperature conditions in the coach. The bypass heat (coolant control) valve provides a path for coolant flow when all evaporator heat valves are closed. The other coolant control valve is the heat valve that controls the flow of coolant to the driver heater coil. The check valve is installed in the compressor refrigerant discharge line and allows refrigerant flow in only one direction to prevent liquid return to the compressor when the compressor is shut down.

1.3 REFRIGERATION SYSTEM COMPONENT SPECIFICATIONS

a. Refrigerant Charge

R-134a: 17.5 lb *(8 kg)*

b. Compressor

Model: 05G
No. of Cylinder: 6
Weight (Dry): 145 lb *(66 kg)* including clutch
Oil Charge:
New Compressor: 5.8 pints *(2.7 liters)*
Replacement Compressor: 5.5 pints *(2.6 liters)*
Oil Level:
Level in sight glass between bottom of glass and middle of glass on compressor crankcase (curbside)
Approved Compressor Oils - R-134a:
Castrol: Icematic SW68C
Mobil: EAL Arctic 68
ICI: Emkarate RL68H

c. Thermostatic Expansion Valve - for R-134a Units:

1. Main Evaporator:

Superheat Setting (Nonadjustable): 12 to 18°F *(6.7 to 10.1°C)*
MOP Setting: None

2. Driver Evaporator and Parcel Rack Evaporator:

Superheat Setting (Nonadjustable): 5 to 12°F *(6.7 to 10.1°C)*
MOP Setting: None

d. High Pressure Switch (HPS):

Opens at: 385 ±10 psig *(26.2 ± .68 BAR)*
Closes at: 285 ±10 psig *(19.39 ± .68 BAR)*

1.4 ELECTRICAL SPECIFICATIONS - WOUND FIELD MOTORS

a. Main Evaporator/Heater Blower (Fan) Motor

Bearing Lubrication: Factory Lubricated (additional grease not required)
Horsepower:
High Speed: 1.6 *(1.2 kw)*
Low Speed: 0.7 *(0.5 kw)*
Full Load Amps (FLA):
High Speed: 56
Low Speed: 28
Operating Speed:
High Speed: 1550 rpm
Low Speed: 1200 rpm
Voltage: 24 vdc

b. Driver Evaporator/Heater Blower (Fan) Motor

Bearing Lubrication: Factory Lubricated (additional grease not required)
Full Load Amps (FLA): 9.5
Operating Speed:
High Speed: 3300 rpm
Medium Speed: 1600 rpm
Low Speed: 1100 rpm
Voltage: 24 vdc

c. Condenser Fan Motor

Bearing Lubrication: Shell Dolium R
Horsepower: 0.8 hp *(1.072 kw)*
Full Load Amps (FLA):
High Speed: 32
Low Speed: 21
Operating Speed:
High Speed: 1800 rpm
Low Speed: 1600 rpm
Voltage: 24 vdc

d. Parcel Rack Evaporator Fan Motor

Bearing Lubrication: Factory Lubricated (additional grease not required)
Full Load Amps (FLA): 9.5
Operating Speed: 3300 rpm
Voltage: 24 vdc

1.5 ELECTRICAL SPECIFICATIONS-MAIN CONTROLLER INPUT SENSORS AND TRANSDUCERS

a. Suction and Discharge Pressure Transducer

Supply Voltage: 4.5 to 5.5 vdc (5 vdc nominal)
Input Range: –6.7 to 450 psig *(–0.05 to 30.62 BAR)*
Output Voltage: vdc = 0.0098 x psig
\+ 0.4659 (See Table 4-5 for calculations.)

b. Temperature Sensors

Input Range: –52.6 to 158°F *(–47 to 70°C)*
Output: NTC 10K ohms at 77°F *(25°C)*
(See Table 4-3 for calculations.)

1.6 SAFETY DEVICES

System components are protected from damage caused by unsafe operating conditions with safety devices. Safety devices that are connected to Carrier Transicold supplied equipment include a high pressure switch (HPS), fuses (See Table 1-3.) and a fusible plug.

In addition, evaporator and condenser fan motors and the main control box are protected independently against high current draw by circuit breakers supplied by the coach manufacturer. The evaporator and condenser fan motors are also protected from high temperature with internal thermal protection switches. If a condenser fan motor safety device opens to stop the condenser fan motor(s), the system may develop a high pressure condition, which may open the high pressure switch (HPS) to shut the unit down.

a. Pressure Switches

High Pressure Switch (HPS)

The high pressure switch (HPS) is installed in the compressor center cylinder head and opens on a pressure rise to shut down the system when high pressure conditions occur. (Refer to: 1.3.d.)

During the A/C mode, HVAC system operation will automatically stop if the HPS switch contacts open due to an unsafe operating condition. Opening HPS contacts de-energizes, through the main controller, the A/C compressor clutch and condenser fan relays shutting down the system.

b. Fuses

Fuses (F2 and F3)

Fuse (F2), internal to the controller, protects the controller 12 vdc supply circuit from excessive current draw. Fuse (F3) protects the controller 24 vdc output circuit from excessive current draw.

c. Thermal Switches

Condenser Motor Overloads (CMOL1 and CMOL2)

Each condenser fan motor is equipped with an internal thermal protector switch, condenser motor overloads (CMOL1 and CMOL2). If excessive motor temperature exists, the CMOL switch will open to de-energize the corresponding condenser fan relay (CFR1 or CFR2); this will stop the affected condenser motor.

Table 1-3. Safety Devices (For Carrier Supplied Equipment)

Unsafe Condition	Safety Device	Device Setting
High compressor discharge pressure	High Pressure Switch (HPS)	Refer to 1.3.d.
Excessive current draw by the controller 12 vdc supply circuit	Fuse (F2)	Opens at 5 amps
Excessive current draw by the controller 24 vdc output circuit	Fuse (F3)	Opens at 10 amps

1.7 HEATING (ENGINE COOLANT) FLOW CYCLE

Heating circuit components furnished by Carrier Transicold include heater cores and evaporator heat valves (EHV) for the driver and main evaporator assemblies and a coolant bypass heat valve. Components furnished by the coach manufacturer include auxiliary heater and engine water pump, auxiliary heater, hand valves and "Y" type strainers. The main controller automatically controls the EHV valves during heating and reheat cycles to maintain required temperatures inside the coach. Engine coolant (glycol solution) is circulated through the heating circuit by the engine and auxiliary water pumps. When the evaporator heat valve solenoid is de-energized, the valve will open to allow engine coolant to flow through the heater coil. (See Figure 1-11.) The valve is normally open so that if a failure occurs, the system will still be able to supply heat.

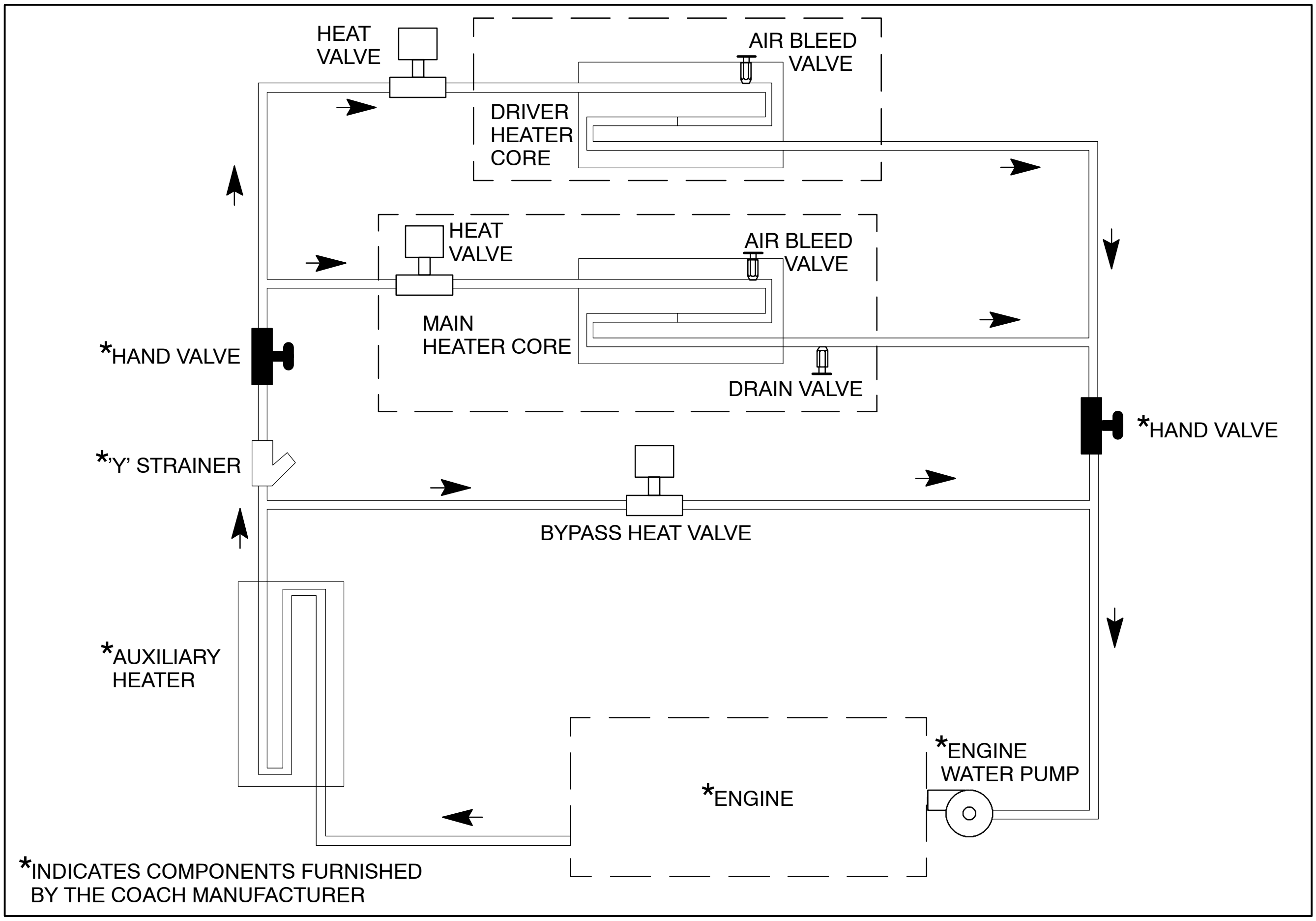


Figure 1-11. Heating System Flow Diagram

1.8 AIR CONDITIONING REFRIGERANT CYCLE

When air conditioning (cooling) is selected by the main controller, the unit operates as a vapor compression system using R-134a as a refrigerant. The main components of the system are the reciprocating compressor, air-cooled condenser coil, subcooler, filter-drier, thermostatic expansion valves, liquid line solenoid valves and evaporator coils. (See Figure 1-12)

The compressor raises the pressure and the temperature of the refrigerant and forces it through the discharge line, and the check valve into the condenser tubes. The condenser fan circulates surrounding air (which is at a temperature lower than the refrigerant) over the outside of the condenser tubes. Heat transfer is established from the refrigerant (inside the tubes) to the condenser air (flowing over the tubes). The condenser tubes have fins designed to improve the transfer of heat from the refrigerant gas to the air; this removal of heat causes the refrigerant to liquefy.

The refrigerant leaves the condenser and then flows through the subcooler, which subcools the refrigerant before it enters the thermal expansion valves; this reduces flash gas in the evaporator. From the subcooler, the liquid refrigerant passes through the liquid line (King) service valve, and then through a filter-drier where an absorbent keeps the refrigerant clean and free of water.

From the filter-drier, the liquid refrigerant then flows through the main liquid line solenoid valve to the main evaporator and thermal expansion valve and to the parcel rack evaporator solenoid valve (if this option is active) the parcel rack thermal expansion valve and through the driver solenoid valve (if this option is active) and to the driver thermal expansion valve. The solenoid valves open during cooling to allow refrigerant to flow to the thermal expansion valves. The main liquid solenoid valve and the parcel rack liquid line solenoid valve (when so equipped) closes during shutdown to prevent refrigerant migration. The thermal expansion valves reduce the pressure and temperature of the liquid and meters the flow of liquid refrigerant to the evaporator to obtain maximum use of the evaporator heat transfer surface.

The low pressure, low temperature liquid that flows into the evaporator tubes is colder than the air that is circulated over the evaporator tubes by the evaporator blower (fan). Heat transfer is established from the evaporator air (flowing over the tubes) to the refrigerant (flowing inside the tubes). The evaporator tubes have aluminum fins to increase heat transfer from the air to the refrigerant; therefore the cooler air is circulated to the interior of the coach.

The transfer of heat from the air to the low temperature liquid refrigerant in the evaporator causes the liquid to vaporize. This low temperature, low pressure vapor passes through the suction line and returns to the compressor where the cycle repeats.

When ventilation only is selected by the main controller, only the evaporator fans function to circulate air throughout the coach. The refrigerant cycle will remain off.

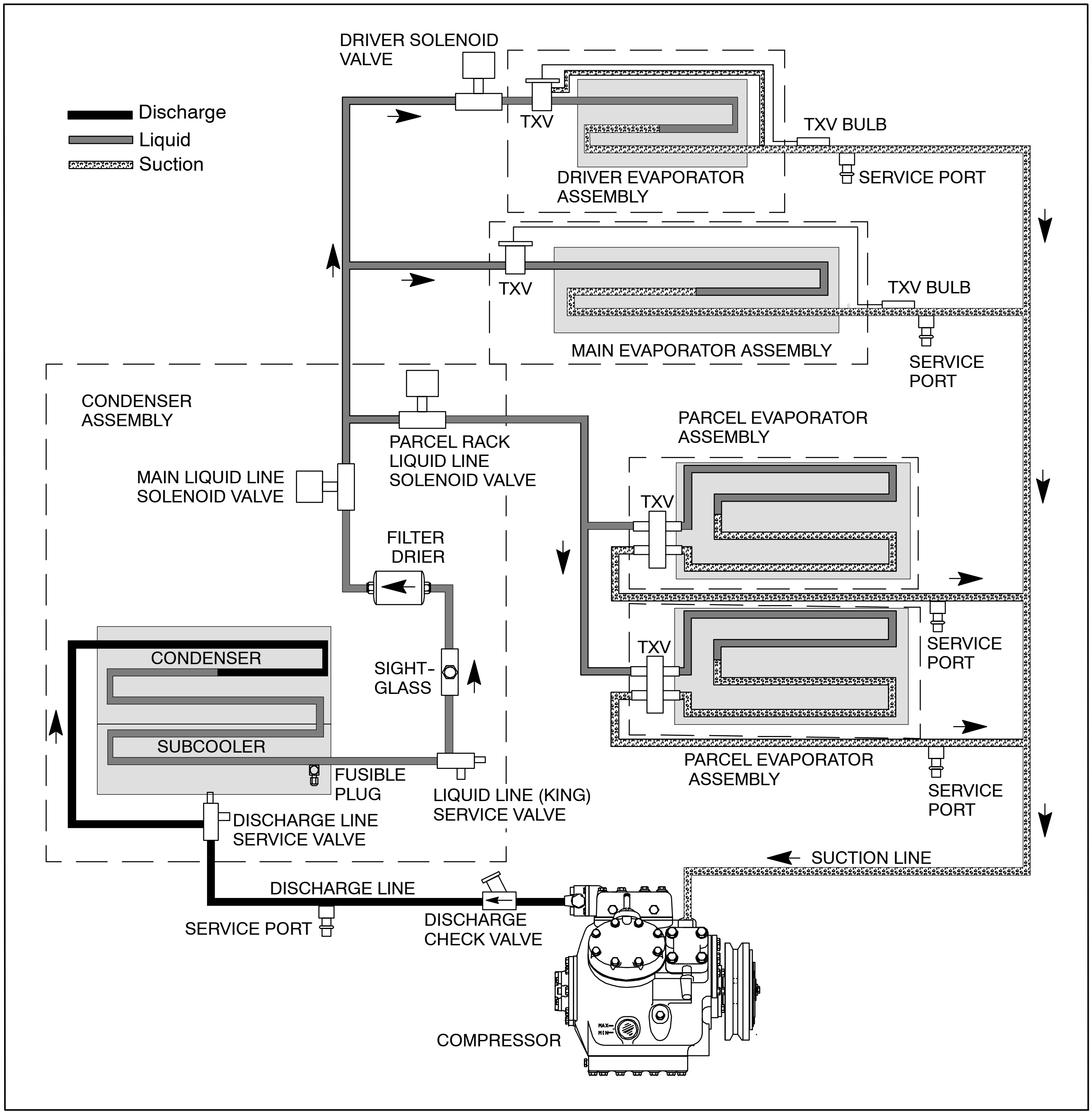


Figure 1-12 Air Conditioning Refrigerant Flow Diagram

1.9 ELECTRONIC AUTOMATIC CONTROL DATA FLOW

The system is supplied with 12 and 24 vdc power from the coach power supply. The main controller receives input from pressure transducers, temperature sensors, condenser and evaporator fan motor overloads, high pressure switch, fuses. It then processes these inputs to control output devices enabling automatic control of temperature conditions inside the coach. The driver display provides a communication link between the main controller and the rest of the system. The following block diagram (Figure 1-13) indicates data flow through the system. Refer to section 2 for more detailed information on the theory of operation of the control system and see section 5 for system electrical schematics.

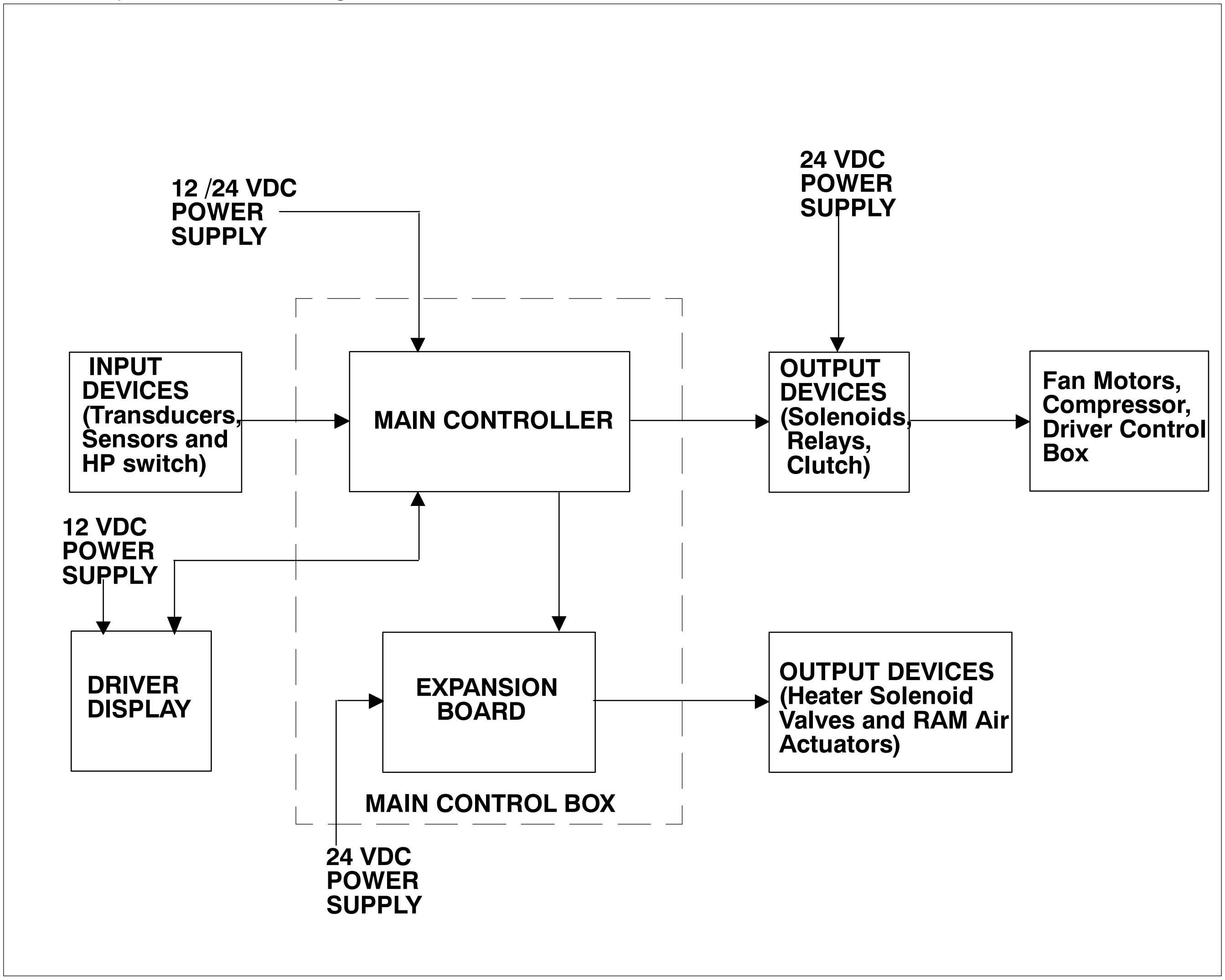


Figure 1-13. Electronic Automatic Control Data Flow Block Diagram

SECTION 2

OPERATION

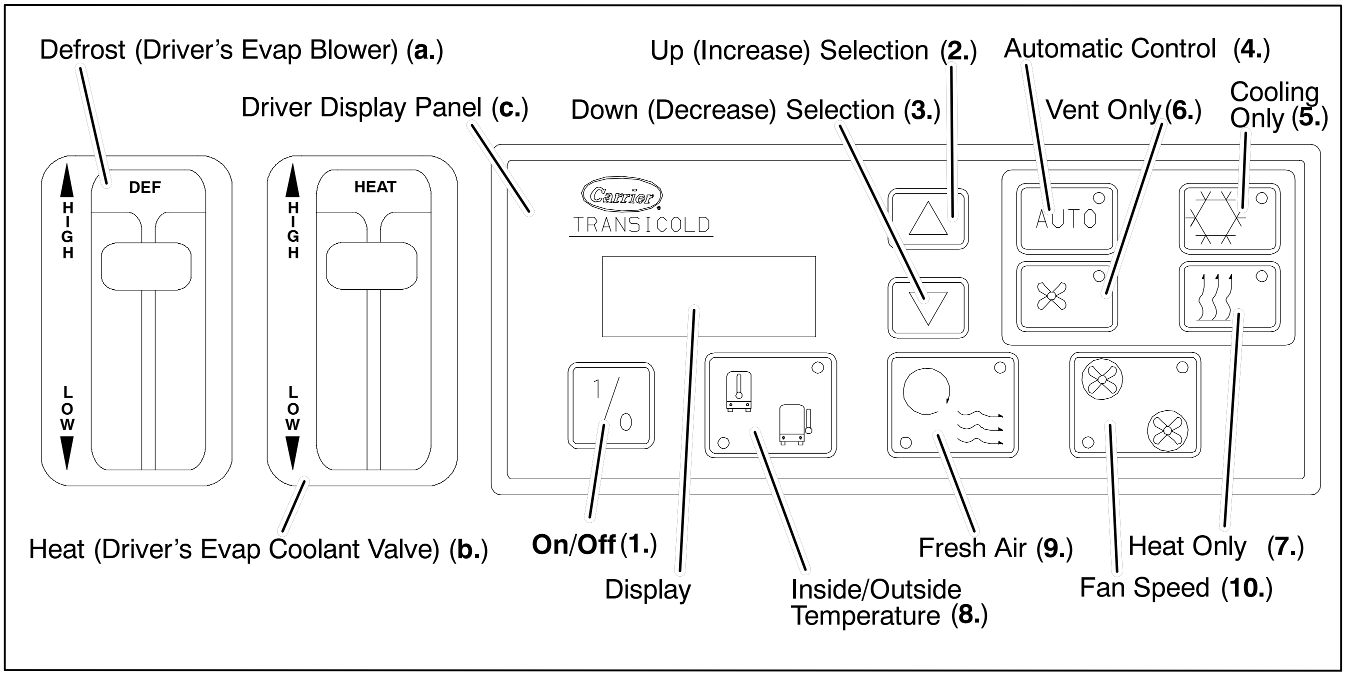


Figure 2-1. System Operating Controls (upper left hand switch panel)

2.1 STARTING, STOPPING AND OPERATING INSTRUCTIONS

2.1.1 Operating Controls

There are five operating controls (Figure 2-1) used to control the functions of this system. They are as follows:

a. The Defrost Switch controls the driver evaporator blower motor speeds. With this switch the driver controls the amount of air discharged to the windshield. This function is independent of any other HVAC function in the coach.

b. The Heat Switch controls the coolant valve to the driver's evaporator. With this switch the driver controls the amount of engine coolant flowing thru the driver's evaporator heater core, hence increasing or decreasing the temperature of air that is discharged to the windshield. This function is independent of any other HVAC function in the coach.

c. The Driver Display Panel controls the Carrier Transicold microprocessor controller which in turn controls the operation of the heating and air conditioning system. With this control the driver controls the temperature of air to the passenger area and cooling to the driver area. The panel has 10 keys whose functions are described as follows:

1. On/Off - Pressing this key will change the display state from inactive to active. If the controller is active the display will illuminate and the other keypad LEDs will be active.
2. Up (Increase Selection) - If the set point is displayed when the Up key is pressed, the display will increase set point 1°F *(0.5°C).*
3. Down (Decrease Selection) - If the set point is displayed when the Down key is pressed, the display will decrease set point 1°F *(0.5°C).*
4. Auto (Auto Control Selection) - Pressing the Auto button illuminates the AUTO LED and signals the controller to automatically cycle to the control set point. If the AUTO LED is illuminated, the manual modes will be de-activated, the COOL, VENT, and HEAT LED's will not be illuminated.
5. Cool (Cool Mode Selection) - If the COOL button is pressed, the COOL LED is illuminated, the system will only cool to control set point. The AUTO, VENT, and HEAT LED's will not be illuminated.
6. Vent (Ventilation Mode Selection) - If the VENT button is pressed, the VENT LED is illuminated, only the system fans will operate. The AUTO, COOL, and HEAT LED's will not be illuminated.
7. Heat (Heat Mode Selection) - If the HEAT button is pressed, the HEAT LED is illuminated, the system will operate in the heat mode only, cycling the coolant control valves as needed to maintain set point. The AUTO, COOL, and VENT LED's will not be illuminated.
8. Inside/Outside Temperature - After start-up, the display shows set point. The temperature display selection button will toggle the display to show bus

inside or outside temperature. The inside temperature is obtained by averaging the curb and road side return air sensors (located in the return air ducts). If one sensor is not functioning the display will read only the functioning sensor, if both are not functioning, the display will show '-40'. The outside temperature sensor is located in the condenser assembly.

When the key is toggled to display the inside temperature, the inside LED will be illuminated. When the key is toggled to display the outside temperature, the outside LED will be illuminated. When the key toggles to show set point, both inside and outside LEDs are turned off.

9. Fresh Air - The Fresh Air Button has two selection LEDs, Fresh Air and Circulation. If the fresh air damper door is open, the Fresh Air LED is illuminated, if the fresh air damper door is closed, the Circulation LED will be illuminated.

   After start-up, the fresh air selection is in AUTO, the controller will control the fresh air damper door. When the key is toggled the damper selection will move to the next step an Auto-Closed-Open-Auto sequence. The Auto selection allows controller to operate the damper, the Closed or Open being the closed or open damper door selections with the damper door held in those respective positions until the button is toggled again.

10. Fan Speed - After start-up, the display obtains the the current fan speed status from the controller. If the controller is in AUTO no fan speed LEDs will be illuminated. When a fan speed is selected the appropriate LED will be illuminated.

11. °F/°C - Key combination is used to select °F or °C. When the display is showing temperature, press and hold the Inside/Outside Temperature selection key(8.) and press the UP key(2.), the display will show in the °F scale. When the display is showing temperature, press and hold the Inside/Outside Temperature selection key(8.) and press the DOWN key(3.), the display will show in the °C scale.

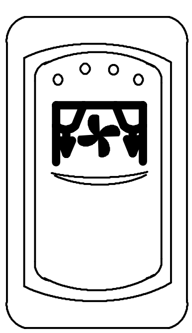


Figure 2-2. Parcel Rack On/Off

d. The Parcel Rack Switch (Figure 1-9) controls the liquid line solenoid valve and the blower motors of the parcel rack evaporators. The driver controls the parcel rack evaporator function with this switch. The parcel rack evaporators will function only after the main evaporator is operating.

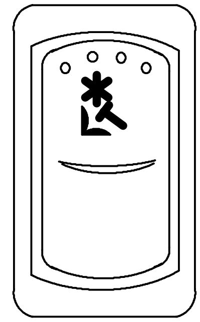


Figure 2-3. Driver A/C

e. The Driver A/C Switch (Figure 2-3) allows the driver to control cooling with the driver's evaporator. When the switch is in AUTO, the driver's area cooling is controlled by the microprocessor controller. When the switch is in COOL, the driver's area is demanding cooling, even if the microprocessor is calling for heating in the passenger area.

2.1.2 HVAC Power to Controller

Before starting the system, electrical power must be available from the coach power supply.

2.1.3 Starting

The Driver Display Panel consists of a display and a keypad (Figure 2-1), which allows the user to modify and observe system operating parameters.

On start-up a self test will execute. While the test is being executed the display will show its programing revision number in the format of X.X, where X is a digit from 1 to 9 (ex. 1.4). At his time three possible error messages may also appear on the display. Refer to Table 3-2 for definitions.

a. If the engine is not running, start the engine. The HVAC system will restart in the AUTO mode. All system controls will operate automatically in heating, cooling or ventilating mode, as required.

b. CONTROL PANEL (Figure 2-1)
   It is suggested the system be started in the automatic mode.

1. The Driver Display Panel may be programmed to display the set point temperature or return air temperature. To determine which display temperature is programmed, press the TEMPERATURE button so that the OUT SIDE AIR indicator is illuminated. If the controller cycles back to the INSIDE AIR indicator, than the controller is programmed to display return air temperature. If the controller does not automatically cycle back to the return air indicator, than the controller is programmed to display set point temperature.
2. The Control Panel will signal the controller to perform start up when the ON/OFF button is pushed. Ensure the AUTO button indicator is illuminated. If not, press the AUTO button to place the system in the automatic mode.
3. If cooling only, heating only or ventilation only is desired, press the corresponding button (refer to Figure 2-1) to illuminate the indicator light and manually place the system in that mode of operation.
4. If low or high speed evaporator fan speed is desired, press the FAN SPEED button to illuminate the indicator light and bring speed to the desired level.

5. To open or close the fresh air damper, press the FRESH AIR button.

6. To read interior or exterior temperature, press the TEMPERATURE button to illuminate the indicator light and bring the display to the desired temperature reading. After a short delay, the display will return to the default set point or return air temperature reading.

7. Setpoint may be changed by pressing the UP or DOWN arrow button. The UP button will increase the setpoint temperature and the DOWN button will decrease the setpoint temperature.

2.1.4 Activating Defrost

Windshield defrost is initiated and controlled with the Defrost switch and the Heat switch (Figure 2-1). Moving the switches to the high setting on both will deliver the highest volume of warm air on the windshield. Correspondingly, moving either or both of the two switches to the low setting will decrease the volume of air and the temperature of air delivered across the windshield.

2.1.5 Active Alarm

During normal operation, the controller monitors system operating parameters for out of tolerance conditions. The display gets the controller alarm queue information every 30 seconds. Alarms will be shown as an alarm code. If an alarm is activated and the display is reading temperature, the display will show the temperature and the alarm code alternately in 1 second intervals.

2.1.6 Diagnostics (Check for Alarms)

If an alarm condition exists, diagnostics can be manually initiated to isolate system fault(s) by simultaneously pressing the Up and Down Selection keys continuously for five seconds. Diagnostics should be accessed only when the coach is not moving. When entering the diagnostic mode, all LEDs for the key pad will be turned off. All keys except the On/Off, Up (increase) Selection and Auto keys will stop functioning. To scroll through the diagnostic information press the UP key. Pressing the O/I key at any time will exit this mode. To clear the alarm message, scroll thru the alarms until '---' appears, then press the Auto Key for 5 seconds or until '---' disappears. Refer to section 3 for description of diagnostics. Refer to Table 3-3 for definition of alarm messages.

2.1.7 Diagnostics (Parameters)

To access the system parameters press the Up and Down Selection keys continuously for five seconds. The display will now be in the Diagnostics mode and may be displaying alarms. Scroll thru the alarms (if present) until '---' appears. With '---' displayed on the read-out, press the Up Selection key. The first parameter code will be displayed. To scroll thru the parameters press the Up Selection key. When showing parameters, the display will first flash out the parameter identifier Pxx for one second and then show the parameter value. To return to normal operation press the On/Off key (see Figure 2-1). Refer to Section 3 for for definitions of the parameter codes.

2.1.8 Stopping

With the system operating, pressing the ON/OFF key will stop the HVAC system operation and the display will be blank.

2.2 PRE-TRIP INSPECTION

After starting system operation, allow system to stabilize for ten to fifteen minutes and check for the following:

a. Listen for abnormal noises in compressor or fan motors.

b. Check compressor oil level. (Refer to paragraph 4.12.4)

c. Check refrigerant level. (Refer to paragraph 4.7.1)

d. Ensure that self-test has been successfully performed and that there are no errors or alarms indicated. (Refer to paragraph 2.1.5 or 2.1.6)

2.3 SYSTEM DESCRIPTION

Refer to Section 5 for sample schematic diagrams of the power and control circuits.

2.3.1 Pull Up and Pull Down Modes

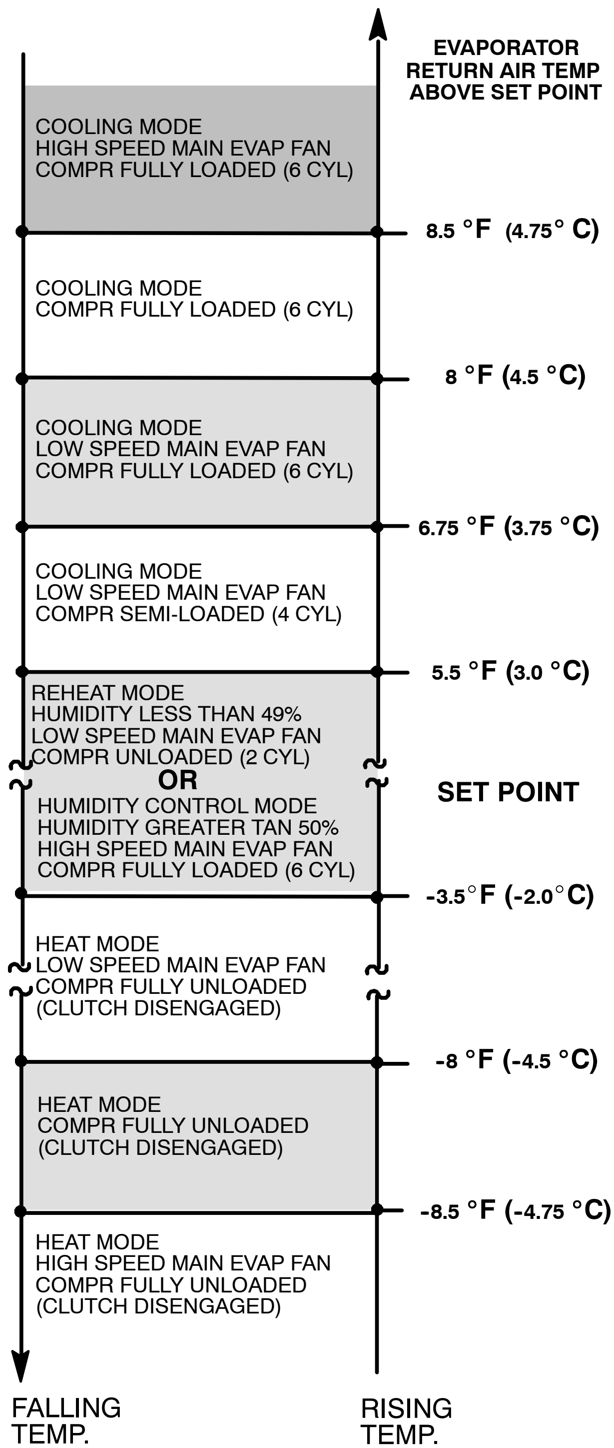
At power up, the system will enter a pull up or pull down mode to rapidly obtain desired temperatures within the coach. During this mode, the system will run at maximum heating or cooling capacity until the set point (in the passenger zone) is reached for the first time. For the driver zone, temperature control is controlled by the two slide switches next to the controller (See Figure 2-1).

1. Pullup/pulldown main evaporator fan speed is limited to a maximum of thirty minutes and can be put in pullup/pulldown speed only once. When the controller switches out of pullup/pulldown speed, pullup/pulldown speed is prevented again by the controller unless the controller is shut off and restarted. The display cannot override the fan speed to pullup/pulldown.

2. The minimum run time in pullup or pulldown for the main evaporator fans is three minutes for automatic control.

a. Capacity State Selection

The main controller automatically compares system temperature with the controller set point and changes system operating modes at certain temperature deviations. Figure 2-4 shows various changes in operating modes and controller actions at various temperature deviations from controller set point. Upon rising temperature, mode changes occur at values in Figure 2-4 above controller set points, On a falling temperature, mode changes occur when temperatures are equal to those given in Figure 2-4 The system will operate in these modes unless pressure overrides the controller settings. If the controller detects that the temperature setting is not being reached during a period of time, it will slowly adjust the temperature at which these modes are entered; this will allow the system to always attempt to reach the controller temperature setting.



For humidity control refer to 2.3.4

Figure 2-4. Main Controller Automatic Control Sequence

b. Cooling/Reheat

Cooling and reheat require various combinations of evaporator fan speeds and compressor unloading. Cooling is accomplished by energizing the compressor and condenser, opening the liquid solenoid valve and closing the heating valve. The compressor clutch and condenser fan motors are energized as appropriate.

Reheat allows for both net cooling and net heating by varying the time that the heat valve is open. The time is automatically calculated by the controller and is based on a 20 second period.

c. Heating

In the heat capacity state, the liquid solenoid valve is closed to stop cooling and the compressor will shut down. The heating capacity can then be varied by adjusting the time the heat valve is open. The time is automatically calculated by the controller and is based on a 20 second period.

d. Driver Area Control

The Driver's A/C switch on the left side console is turned on when cooling is desired in the driver area.

The driver area conditions are controlled by manually adjusting the Defrost and Heat slide switches on the dash board. These controls operate in conjunction with the main coach controller. Temperature control is accomplished by regulating the flow of engine coolant through the heating coil in the driver evaporator (with the Heat slide switch) by controlling a normally open electric solenoid valve. The volume of air flow directed about the driver area is controlled (with the Defrost slide switch) by the speed of the drivers evaporator fan motors.

The heating coil reheats the precooled air to maintain the desired temperature at the set point. During heating, the driver area liquid solenoid valve is closed and the heating valve is opened and closed for a percentage of the heat valve period.

e. Passenger Area Control

The passenger area temperature is controlled by maintaining the return air temperature as measured by the return air sensors located at the rear of the coach in the return air ducts. The return air sensors are averaged together to provide input for the controller.

If cooling is required for the passenger area, the compressor and condenser will start and the main liquid line solenoid valve is opened and the heat valve is closed.

During reheat, the main liquid solenoid valve is opened and the heating valve is opened and closed for a percentage of the heat valve period (20 seconds).

To enter the heat mode for the passenger area, the controller must be calling the heat valve to be cycling at 51% or higher. If this condition is not met, the area requiring heat is put into reheat. During heating, the main evaporator liquid solenoid valve is closed and the heating valve is opened and closed for a percentage of the heat valve period (20 seconds). Once the heat mode has been entered, the controller will not re-enter heat until the heat valve has closed to less than 25%.

2.3.2 Bypass Heat Valve Control

The normally open Bypass Heat Valve is closed on system start-up. During re-heat, the bypass heat valve remains closed when the heat valves are open, and opens 2 seconds before the heat valves close (to prevent water hammering).

2.3.3 Auxiliary Heater Control

The auxiliary heater output is energized when the heat valve has been opened 100% for 60 seconds. Once energized, the auxiliary heater output is de-energized when the heat valve percentage is less than 20 percent for fifteen minutes.

The OEM supplied Auxiliary Heater Switch located on the left side console can independently energize the auxiliary heater when the engine is off. When placing the switch in the ON position, the switch activates the auxiliary heater for a timed period of 90 minutes. Placing the switch in the OFF position or starting the coach engine will de-activate the auxiliary heater.

2.3.4 Humidity Control

Humidity control (reheat mode) is activated when the humidity is greater than fifty percent and the passenger zone temperature is less than 5°F (3°C) above set point. When these conditions are met the compressor will be fully loaded (6 cylinders)and at the same time the heat valve(s) will cycle open to maintain temperature. Once humidity control is activated, it will remain activated until the humidity is less than 45 percent or the return air temperature drops 2°F (1°C) below set point.

2.3.5 Compressor Unloader Control

The unloader outputs control the capacity of the compressor by energizing or de-energizing unloader solenoid valves. Energizing a valve solenoid de-activates a pair of compressor cylinders. The 05G compressor has six cylinders. Four cylinders are equipped with two sets of unloader valves (UV1 and UV2), each controlling two cylinders; this allows the compressor to be operated with two, four or six cylinders. When the compressor is off, the unloader solenoids are de-energized immediately.

Whenever the compressor is changed from off to on, the unloaders are forced energized for fifteen seconds. After fifteen seconds, one unloader solenoid may be de-energized, if required. Any subsequent changes between energizing and de-energizing the unloader solenoids must be staged with a thirty second delay. Only one unloader may change state at a time when staging is required.

a. Suction Pressure

In addition to temperature control, the electric unloaders will be used to prevent coil frosting. Staging is ignored for energizing the unloader solenoid due to suction pressure overrides :

1. Compressor Unloader Bank 1 Solenoid (UV1). When the suction pressure decreases below 25 psig (*1.7 BAR*), the first unloader solenoid is energized unloading the first compressor cylinder bank (two cylinders); this output will remain energized until the pressure increases to above 32 psig (*2.18 BAR*).
2. Compressor Unloader Bank 2 Solenoid (UV2). When the suction pressure decreases below 21 psig *(1.43 BAR)*, the second unloader solenoid is energized unloading the second compressor cylinder bank (two cylinders); this output will remain energized until the pressure increases to above 28 psig *(1.91 BAR)*.

b. Discharge Pressure

Head Pressure is also controlled by the unloaders. Staging is ignored for energizing the unloader solenoid due to discharge pressure overrides :

1. Compressor Unloader Bank 1 Solenoid (UV1). When the discharge pressure increases above 340 psig *(23.13 BAR)*, the first compressor unloader solenoid is energized; this output will remain energized until the pressure decreases below 300 psig *(20.41 BAR)*.

2.3.6 Passenger Area Evaporator Fan Speed Selection

The passenger area evaporator assembly is equipped with a two speed fan motor. Temperature control is the primary method of determining the fan speed selection. Table 2-1 indicates relay operational status for the various fan motor states.

Table 2-1. Main Evaporator Fan Speed Relay Operation

STATE	HIGH SPEED RELAY	LOW SPEED RELAY
Off	Off	Off
Low	On	On
High	On	Off
Pull Up/Down	On	Off

2.3.7 Driver's Area Evaporator Fan Speed Selection

The driver air conditioning unit is equipped with two evaporator fan motors. The Defrost slide switch determines the fan speed. See (Figure 2-1).

2.3.8 Condenser Fan Speed Control

The first condenser fan motor (CM1) is energized when the compressor clutch output is energized.

The second condenser fan motor (CM2) is energized when the clutch is energized and the discharge pressure increases above 175 psig *(1.2 mkPa)*. It will be de-energized when the clutch is de-energized or the discharge pressure decreases below 125 psig *(0.861 mPa)*.

The condenser fans are started in low speed and will remain in low speed until the discharge pressure increases above 225 psig *(1.6 mPa)*. The fans will remain in high speed until the discharge pressure decreases below 165 psig *(1.1 mPa)*.

2.3.9 Staging

When the system is started, the fans are staged on to reduce the total starting current. There is no staging required for the driver evaporator fan motors, as they start immediately. Staging for the evaporator and condenser fan motors are given in the Table 2-2.

Table 2-2. Main area Staging

Ref.	Time (seconds)	Controller Action
Time 0	0	Main Evaporator Fan Low
Time 2	Time 0 + 2	Main Evaporator Fan High
Time 3	Time 0 + 4	Condenser Fan 1 Low
Time 4	Time 3 + 1	Condenser Fan 2 Low
Time 5	Time 3 + 3	Both Condenser Fans High

2.3.10 Compressor Clutch Control

A belt driven electric clutch is employed to transmit engine power to the air conditioning compressor. De-energizing the clutch electric coil disengages the clutch and removes power from the compressor. The clutch will be engaged whenever any area is calling for cooling. The clutch will be disengaged when the system is off, when all areas are in heating or during high and low pressure conditions. The clutch coil is controlled by the main controller.

The clutch coil is prevented from engagement when the ambient temperature is below 32°F *(0°C)*.

The clutch coil will be de-energized if the discharge pressure rises to 350 psig *(2.4 mPa)*, the setting of the compressor mounted high pressure switch. The clutch coil will energize when the discharge pressure falls to 240 psig *(1.7 mPa).*

The clutch coil will be de-energized if the suction pressure decreases below 6 psig *(41 kPa).*

2.3.11 RAM Air Control

The RAM air control regulates admission of outside air into the system.

a. Display Override

The RAM air can be automatically controlled or set to open or closed by the display.

b. RAM Air Auto Mode

1. If the passenger return air temperature is greater than controller set point plus 2°F *(1.1°C)* or less than set point minus 2°F *(1.1°C),* the RAM air will be closed.
2. Otherwise, RAM air is open.

An exception to the above is that there is a five minute delay to open RAM air once it is closed in the auto mode. There is no delay to close RAM air.

2.3.12 Startup

At startup, the controller will power on and perform all power up tests.

2.3.13 Input Processing

The system determines correct operation by reading temperature sensors (thermistors), pressure transducers and the humidity sensor. Refer to section 1.5 for electrical specifications for input devices and sections 1.2.1, 1.2.2 and 1.2.6 for functional descriptions.

2.3.14 Self Tests

With the engine running, self tests are automatically executed.

“ER5” indicates a data memory failure. “ER6” indicates a program memory failure. If any of these or any other errors are displayed on the screen, proceed to Table 3-1.

2.3.15 Alarm Description

Alarm descriptions and troubleshooting procedures are provided in section 3.

2.3.16 Hour Meters

An hour meter records the compressor run time in hours. The maximum reading is 999,999.

An Hourmeter records the total elapsed time the controller has been on in hours. The maximum reading is 999,999.

2.3.17 Communications (Driver Display - Controller)

The controller uses communications to transmit data to the display. The communications link is RS232.

SECTION 3
TROUBLESHOOTING

CAUTION

Do not under any circumstances attempt to service the microprocessor. Should a problem develop with the microprocessor, replace it.

NOTE

To access LED display on the microprocessor, remove cover from main control box located in rear of electrical compartment.

Table 3-1. Microprocessor Error Message Definition

ERROR CODE	STATUS OF LED DISPLAY	REMEDY
0	1 sec on - 1 sec off	Not Applicable as system is operating normally.
1	1 flash - 5 sec pause	Record error code number, tag and replace the microprocessor.
2	2 flashes - 5 sec pause	Record error code number, tag and replace the microprocessor.
3	3 flashes - 5 sec pause	Record error code number, tag and replace the microprocessor.
4	4 flashes - 5 sec pause	Record error code number, tag and replace the microprocessor.
5	5 flashes - 5 sec pause	Record error code number, tag and replace the microprocessor.
6	6 flashes - 5 sec pause	Record error code number, tag and replace the microprocessor.

Table 3-2. Display Error Message Definition

ERROR CODE	MESSAGE	MESSAGE DEFINITION
Er4	Communications Failure	If the display does not receive data from the microprocessor.
Er5	Data Memory	If memory on the display is not verified on power up.
Er6	Program Memory	If program memory on the display is not verified on power up by a checksum.

Table 3-3. Driver Display Panel Alarm Message Definition

ALARM NO.	TITLE	CAUSE	REMEDY	MICROPROCESSOR RESPONSE
A11	Main Left Probe Failure	Sensor is unplugged, wiring defective or main left evaporator return air temperature sensor failure.	Ensure sensor is plugged in. Check sensor resistance or wiring. Replace sensor or repair wiring. (Refer to section 4.13 and Table 4-3.)	Switches to the right probe. If both probes are bad, the microprocessor will run in the full reheat and evaporator fans will operate on low speed. The compressor will operate on six cylinders if pressures permit.
A12	Main Right Probe Failure	Sensor is unplugged, wiring defective or main right evaporator return air temperature sensor failure.	Ensure sensor is plugged in. Check sensor resistance or wiring. Replace sensor or repair wiring. (Refer to section 4.13 and Table 4-3.)	Switches to the left probe. If both probes are bad, the microprocessor will run in the full reheat and evaporator fans will operate on low speed. The compressor will operate on six cylinders if pressures permit.

Table 3-3. Driver Display Panel Alarm Message Definition - Continued				
ALARM NO.	TITLE	CAUSE	REMEDY	MICROPROCESSOR RESPONSE
A14	Ambient Probe Failure	Sensor is unplugged, wiring defective or ambient temperature sensor failure.	Ensure sensor is plugged in. Check sensor resistance or wiring. Replace sensor or repair wiring. (Refer to section 4.13 and Table 4-3.)	Ignores ambient temperature and does not lock out the compressor and does not open driver RAM air in AUTO mode.
A15	Suction Pressure Transducer Failure	Sensor is unplugged, wiring defective or suction pressure transducer failure.	Ensure sensor is plugged in. Check transducer voltage or wiring. Replace sensor or repair wiring. (Refer to section 4.15 and Table 4-5.)	Energizes unloaders.
A16	Discharge Pressure Transducer Failure	Sensor is unplugged, wiring defective or discharge pressure transducer failure.	Ensure sensor is plugged in. Check transducer voltage or wiring. Replace sensor or repair wiring. (Refer to section 4.15 and Table 4-5.)	Energizes unloaders.
A17	Humidity Transducer Failure	Sensor is unplugged, wiring defective or humidity transducer failure.	Ensure sensor is plugged in. Check transducer voltage or wiring. Replace sensor or repair wiring. (Refer to section 4.14 and Table 4-4.)	If conditions allow, not including the humidity set point/humidity sensor condition, activates humidity control (dehumidification). (See section 2.3.4.) Does not open passenger RAM air in AUTO. (Refer to section 2.3.11.)
A18	Fuse Blown Alarm	Defective wiring or coach power source defective. microprocessor Internal fuse is blown.	Repair or replace wiring or power source. Replace Fuse.	All microprocessor outputs are de-energized.
A19	Main Evaporator Fan Overload	Main evaporator fan overload.	Refer to section 3.3.6.	No microprocessor response other than alarm.
A22	Condenser Fan Overload	Condenser fan overloads	Refer to section 3.3.3 and/or 3.3.4	If the compressor is energized and the first condenser fan overload opens, the microprocessor will energize the second condenser fan in order to detect the first overload condition. If, after energizing the second condenser fan, the second condenser fan overload opens, the compressor clutch will de-energize for the minimum off time, since neither condenser fan is operating.

Table 3-3. Driver Display Panel Alarm Message Definition - Continued				
ALARM NO.	**TITLE**	**CAUSE**	**REMEDY**	**MICROPROCESSOR RESPONSE**
A22	Condenser Fan Overload (continued)	Condenser fan overloads	Refer to section 3.3.3 and/or 3.3.4	If after energizing the second condenser fan, the second condenser fan overload does not open, the microprocessor will keep the first overload alarm activated and leave the compressor and second condenser fan energized. (The second condenser fan remains energized since at least one condenser fan must be energized when the compressor is energized.)
A23	High Pressure Discharge	High discharge pressure.	Check discharge pressure transducer voltage, wiring or cause of high discharge pressure. (Refer to section 4.15 and Table 4-5 and/or section 3.3.3.)	If this alarm has not been activated three times in 30-minutes, it de-energizes the clutch for the minimum off time and until the alarm is de-activated. Energizes the second condenser fan at high speed. De-energizes the rest of the system unless heat is required. If this alarm has been re-activated three times in 30-minutes, it de-energizes the rest of the system. The system will operate only in the heat mode until the alarm is reset via communications.
A25	Out of Range	If the system is controlling within 9°F (5°C) of setpoint for a period of 15 minutes and then fails to control within 18°F (10°C) for any reason this alarm will be activated.	Refer to section 3.3.1, 3.3.2 and/or 3.3.8 depending on heating/cooling requirements.	No microprocessor response other than alarm.
A26	Low Voltage/ Load Shed	Low coach voltage. Coach 12 vdc battery supply voltage dropped below 12.6 vdc for 30 seconds.	Check/repair alternator or coach power supply.	De-energizes all outputs except driver evaporator fan motor. (See section 2.1.2.)

Table 3-3. Driver Display Panel Alarm Message Definition - Continued				
ALARM NO.	**TITLE**	**CAUSE**	**REMEDY**	**MICROPROCESSOR RESPONSE**
A27	Low Pressure Shutdown	Low suction pressure.	Check cause of low suction pressure. (Refer to section 3.3.3.)	If alarm has been activated three times in 30-minutes, the clutch will be de-energized until the alarm is de-activated. If alarm has been activated three times in 30-minutes, de-energizes the rest of the system unless heat is required. Runs the main evaporator fan at low speed until alarm is reset.
A28	High Voltage	Power 12 vdc source voltage is greater than 17 vdc.	Check, repair or replace alternator.	All microprocessor outputs are de-energized.
A29	Low Voltage	Power 12 vdc source voltage is less than 10 vdc.	Repair or replace wiring or alternator.	All microprocessor outputs are de-energized.
A31	EEPROM	Memory failure.	Replace main microprocessor at next service stop.	Modifies out of range values to their default values.

Table 3-4. Parameter Codes		
CODE	**CODE NAME**	**DESCRIPTION**
P5	Suction Pressure	This value is the suction pressure measured by the suction pressure transducer. If the sensor is shorted it will display *CL* If it is open circuited it will display *OP*. NOTE: This value is not updated, it is the value at the time that the code is accessed.
P6	Discharge Pressure	This value is the discharge pressure measured by the discharge pressure transducer. If the sensor is shorted it will display “CL” and if it is open circuited it will display “OP”. NOTE: This value is not updated, it is the value at the time that the code is accessed.
P20	Compressor Hours High	This is the number of hours of operation that the compressor has run with the clutch energized. The reading is in thousands.
P21	Compressor Hours Low	This is the number of hours of operation that the compressor has run with the clutch energized. The reading is in hundreds, tens and ones.
P22	Evaporator Hours High	This is the number (in thousands) of hours of operation with the evaporator fans energized.
P23	Evaporator Hours Low	This is the number (in hundreds, tens and ones) of hours of operation with the evaporator fans energized.
P30	Controller Software Version	This is the software version of the logic board. The first two digits of the software revision are displayed. Ex. Revision XXYY XX is displayed after P30.
P31		This is the software version of the logic board. The second two digits of the software revision are displayed. Ex. Revision XXYY YY is displayed after P31.

Table 3-5. General System Troubleshooting Procedures		
INDICATION/ TROUBLE	**POSSIBLE CAUSES**	**REFERENCE SECTION**
3.3.1 System Will Not Cool		
Compressor will not run	V-Belt loose or defective Clutch coil defective Clutch malfunction Compressor malfunction	Check Check/Replace Check/Replace See Note.
Electrical malfunction	Coach power source defective Circuit Breaker/safety device open	Check/Repair Check/Reset
3.3.2 System Runs But Has Insfficient Cooling		
Compressor	V-Belt loose or defective Compressor valves defective	Check See Note.
Refrigeration system	Abnormal pressures No or restricted evaporator air flow Expansion valve malfunction Restricted refrigerant flow Low refrigerant charge Service valves partially closed Safety device open Liquid solenoid valve stuck closed	3.3.3 3.3.6 3.3.7 and 4.11 3.3.7 and 4.11 4.5 and 4.7 Open 1.6 Check
3.3.3 Abnormal Pressures		
High discharge pressure	Refrigerant overcharge Noncondensable in system Condenser fan rotation incorrect Condenser coil dirty	4.4 4.8 Check Clean
Low discharge pressure	Compressor valve(s) worn or broken Low refrigerant charge	See Note. 4.5 and 4.7
High suction pressure	Compressor valve(s) worn or broken	See Note.
Low suction pressure	Suction service valve partially closed Filter-drier inlet valve partially closed Filter-drier partially plugged Low refrigerant charge Expansion valve malfunction Restricted air flow	Open Check/ Open 4.10 4.5 and 4.7 3.3.7 3.3.6
Suction and discharge pressures tend to equalize when system is operating	Compressor valve defective	See Note.
3.3.4 Abnormal Noises Or Vibrations		
Compressor	Loose mounting hardware Worn bearings Worn or broken valves Liquid slugging Insufficient oil Clutch loose, rubbing or is defective V-belt cracked, worn or loose Dirt or debris on fan blades	Check/Tighten See Note. See Note. 3.3.7 4.12.4 Check Check/Adjust Clean
Condenser or evaporator fans	Loose mounting hardware Defective bearings Blade interference Blade missing or broken	Check/Tighten Replace Check Check/Replace

Table 3-5. General System Troubleshooting Procedures - Continued		
INDICATION/ TROUBLE	**POSSIBLE CAUSES**	**REFERENCE SECTION**
3.3.5 Control System Malfunction		
Will not control	Sensor or transducer defective Relay(s) defective Microprocessor malfunction	4.13, 4.15 or 4.14 Check Check
3.3.6 No Evapotator Air Flow Or Restricted Air Flow		
Air flow through coil blocked	Coil frosted over Dirty coil Dirty filter	Defrost coil Clean Clean/Replace
No or partial evaporator air flow	Motor running in reverse Motor(s) defective Motor brushes defective(main evaporator) Evaporator fan loose or defective Fan damaged Return air filter dirty Icing of coil Fan relay(s) defective Safety device open	Check Repair/Replace 4.18/4.19 Repair/Replace Repair/Replace Clean/Replace Clean/Defrost Check/Replace 1.6
3.3.7 Expansion Valve Malfunction		
Low suction pressure with high superheat	Low refrigerant charge Wax, oil or dirt plugging valve orifice Ice formation at valve seat Power assembly failure Loss of bulb charge Broken capillary	4.5 and 4.7 4.6 4.6 4.11.1 4.11.1 4.11.1
Low superheat and liquid slugging in the compressor	Superheat setting too low Ice or other foreign material holding valve open	4.11 4.6
3.3.8 No Or Insufficient Heating		
Insufficient heating	Dirty or plugged heater core Coolant solenoid heat valve(s) malfunctioning or plugged Low coolant level Coolant bypass heat valve open or malfunctioning Strainer(s) plugged Hand valve(s) closed Water pumps defective Auxiliary Heater malfunctioning.	Clean Check/Replace Check Check/Replace Clean Open Repair/Replace Repair/Replace
No Heating	Coolant solenoid heat valve(s) malfunctioning or plugged Microprocessor malfunction Pump(s) malfunctioning Safety device open	Check/Replace Replace Repair/Replace 1.6

NOTE: Refer to Model 05G Compressor Manual, Form No. 62-02756.

SECTION 4

SERVICE

WARNING
BE SURE TO OBSERVE WARNINGS LISTED IN THE SAFETY SUMMARY IN THE FRONT OF THIS MANUAL BEFORE PERFORMING MAINTENANCE ON THE HVAC SYSTEM

NOTE
Following completion of all maintenance or service activities, the alarm queue should be cleared of any original alarms and any alarms generated during service. Refer to paragraph 2.1.6

4.1 MAINTENANCE SCHEDULE

SYSTEM		OPERATION	REFERENCE paragraph
ON	OFF		
a. Daily Maintenance			
X		Pre-trip Inspection – after starting	2.2
	X	Check tension and condition of V-belt	None
b. Weekly Inspection			
	X	Perform daily inspection	4.1.a
	X	Check condenser, evaporator coils and air filters for cleanliness	None
	X	Check refrigerant hoses and compressor shaft seal for leaks	4.5
X		Feel filter-drier for excessive temperature drop across drier	4.10
c. Monthly Inspection and Maintenance			
	X	Perform weekly inspection and maintenance	4.1.b
	X	Clean evaporator drain pans and hoses	None
	X	Check wire harnesses for chafing and loose terminals	Replace/Tighten
	X	Check fan motor bearings	None
	X	Check compressor mounting bolts for tightness	None
	X	Check fan motor brushes	4.19, 4.23

4.2 SUCTION AND DISCHARGE SERVICE VALVES

The suction and discharge service valves (See Figure 4-1) used on the compressor are equipped with mating flanges for connection to flanges on the compressor. These valves are provided with a double seat and a gauge connection, which allows servicing of the compressor and refrigerant lines.

Turning the valve stem counterclockwise (all the way out) will *backseat* the valve to open the suction or discharge line to the compressor and close off the gauge connection. In normal operation, the valve is backseated to allow full flow through the valve. The valve should always be backseated when connecting the service manifold gauge lines to the gauge ports.

Turning the valve stem clockwise (all the way forward) will *frontseat* the valve to close off the suction or discharge line to isolate the compressor and open the gauge connection.

To measure suction or discharge pressure, midseat the valve by opening the valve clockwise 1/4 to 1/2 turn. With the valve stem midway between frontseated and backseated positions, the suction or discharge line is open to both the compressor and the gauge connection.

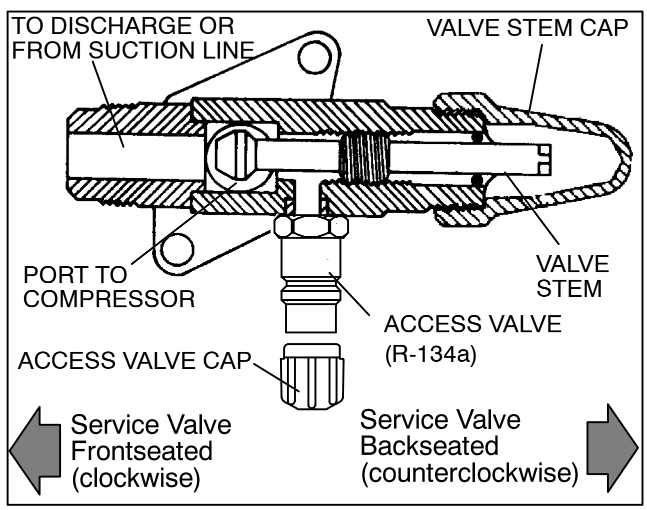
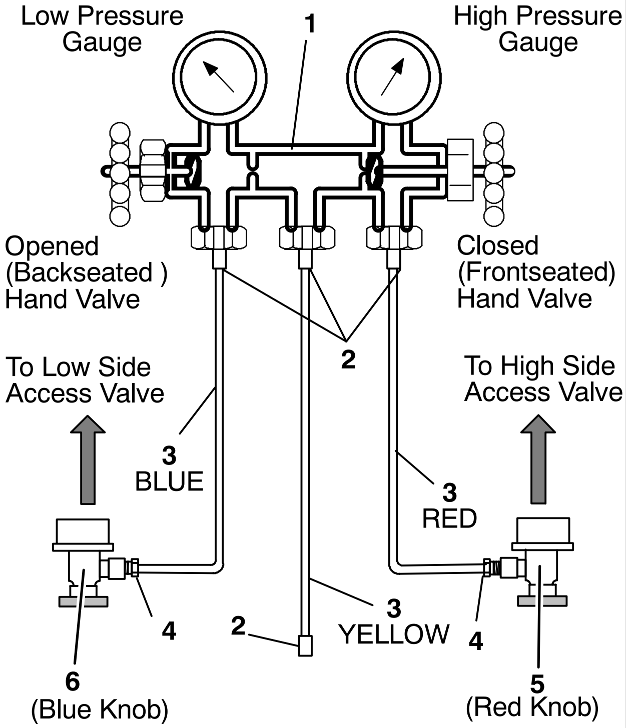


Figure 4-1. Suction or Discharge Service Valve

4.3 INSTALLING MANIFOLD GAUGES

The manifold gauge set can be used to determine system operating pressures, add charge, equalize or evacuate the system.



1. Manifold Gauge Set
2. Hose Fitting (0.5-16 Acme)
3. Refrigeration and/or Evacuation Hose . (SAE J2196/R-134a)
4. Hose Fitting w/O-ring (M14 x 1.5)
5. High Side Field Service Coupler
6. Low Side Field Service Coupler

Figure 4-2. Manifold Gauge Set (R-134a)

4.3.1 Installing R-134a Manifold Gauge Set

An R-134a manifold gauge/hose set with self-sealing hoses is required for service of models covered within this manual. The manifold gauge/hose set is available from Carrier Transicold. (CTD P/N 07-00294-00, which includes items 1 through 6, see Figure 4-2.) To perform service using the manifold gauge/hose set, do the following:

a. Preparing Manifold Gauge/Hose Set For Use

1. If the manifold gauge/hose set is new or was exposed to the atmosphere it will need to be evacuated to remove contaminants and air as follows:
2. Back seat (turn counterclockwise) both field service couplers (See Figure 4-2, items 5 and 6) and midseat both hand valves.
3. Connect the yellow hose to a vacuum pump and an R-134a cylinder.
4. Evacuate to 10 inches (*0.69 BAR*) of vacuum and then charge with R-134a to a slightly positive pressure of 1.0 psig (*0.07 BAR*).
5. Front seat both manifold gauge set hand valves and disconnect from cylinder. The gauge set is now ready for use.

b. Connecting Manifold Gauge/Hose Set

To connect the manifold gauge/hose set for reading pressures, do the following:

1. Remove service valve stem cap and check to make sure it is backseated. Remove access valve cap.
2. Connect the field service coupler (see Figure 4-2, items 5 and 6) to the access valve.
3. Turn the field service coupling knob clockwise, which will open the system to the gauge set.
4. Read system pressures.
5. Repeat the procedure to connect the other side of the gauge set.

c. Removing the Manifold Gauge Set

1. While the compressor is still ON, backseat the high side service valve.
2. Midseat both hand valves on the manifold gauge set and allow the pressure in the manifold gauge set to be drawn down to low side pressure. This returns any liquid that may be in the high side hose to the system.

CAUTION

To prevent trapping liquid refrigerant in the manifold gauge set be sure set is brought to suction pressure before disconnecting.

3. Backseat the low side service valve. Backseat both field service couplers and frontseat both manifold set hand valves. Remove the couplers from the access valves.
4. Install both service valve stem caps and access valve caps (finger-tight only).

4.4 PUMPING THE SYSTEM DOWN OR REMOVING THE REFRIGERANT CHARGE

NOTE

To avoid damage to the earth's ozone layer, use a refrigerant recovery system whenever removing refrigerant.

4.4.1 System Pumpdown

To service or replace the filter-drier, expansion valve, evaporator coil, or suction line, pump the refrigerant into condenser coil as follows:

a. Install manifold gauge set. (Refer to paragraph 4.3)

b. Start the unit and allow it to run in the cool mode for 15 to 20 minutes.

c. Unplug the suction pressure transducer(SPT).

NOTE

The following procedure may have to be repeated several times to maintain the 0 to 2 psig *(6.9 kPa)* pressure depending upon amount of refrigerant absorbed in the oil.

d. Frontseat the liquid line (King) valve by turning clockwise. Start system and run in cooling. Stop the unit when the suction pressure reaches 1 psig (*0.07 BAR*).

e. Frontseat (close) suction service valve to trap the refrigerant in the high side of the system between the compressor suction service valve and the filter drier inlet valve. The low side of the system will now be at 1 psig *(0.07 BAR)* pressure and ready for servicing,

f. Service or replace the necessary component on the low side of the system.

g. Leak check connections. (Refer to paragraph 4.5)

h. Evacuate and dehydrate the low side. (Refer to paragraph 4.6)

i. Reconnect the suction pressure transducer (SPT).

j. Clear the low pressure alarm. (Refer to paragraph 2.1.6)

4.4.2 Removing the Refrigerant Charge

Connect a refrigerant recovery system to the unit at the condenser service (King) valve to remove refrigerant charge. (See Figure 4-4) Refer to instructions provided by the manufacturer of the refrigerant recovery system.

NOTE

1. Before opening up any part of the system, *a slight positive pressure should be indicated on the gauge.*
2. When opening up the refrigerant system, certain parts may frost. Allow the part to warm to ambient temperature before dismantling; this avoids internal condensation, which puts moisture into the system.
3. When opening or closing the service valves, care should be given to note if the packing around the valve stem is worn or may need adjustment to prevent refrigerant leaks.

4.4.3 Refrigerant Removal From An Inoperative Compressor.

To remove the refrigerant from a compressor that is not operational, do the following:

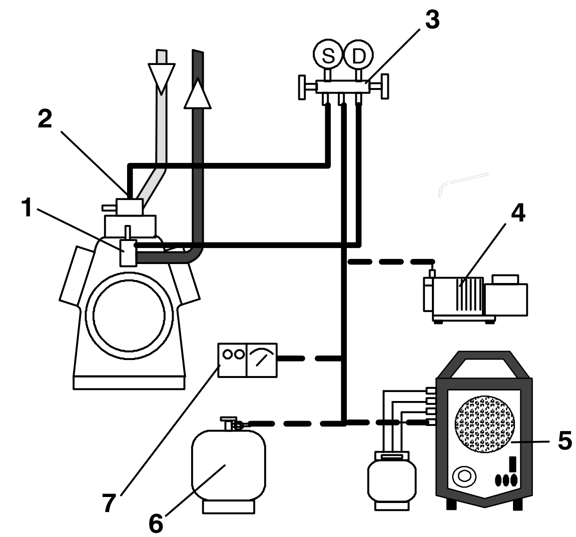
a. Attach a manifold gauge set as shown in Figure 4-3 and isolate the compressor by front seating the suction and discharge valves.

b. Recover refrigerant with a refrigerant reclaimer. If the discharge service valve port is not accessible, it will be necessary to recover refrigerant through the suction service valve port only.

c. Service or replace components as required and leak check the compressor.

d. Using refrigerant hoses designed for vacuum service, connect a vacuum pump to center connection of manifold gauge set. Evacuate compressor to 500 microns. Close off pump valve, isolate vacuum gauge and stop pump. Wait 5 minutes to verify that vacuum holds.

e. Once vacuum is maintained, recharge low side with R-134a to 20 to 30 PSIG by admitting vapor from the refrigerant cylinder. Backseat compressor service valves and disconnect manifold gauge set.



1. Discharge Service Valve and Port
2. Suction Service Valve and Port
3. Manifold Gauge Set
4. Vacuum Pump
5. Reclaimer
6. Refrigerant Cylinder
7. Thermistor Vacuum Gauge

Figure 4-3. Compressor Service Connections

4.4.4 Pump Down An Operable Compressor For Repair

To service an operable compressor, pump the refrigerant into the condenser coil as follows:

a. Install manifold gauge set. (See Figure 4-3)

b. Unplug the suction pressure transducer (SPT).

c. Frontseat the compressor suction service valve by turning clockwise.

d. Start the unit and run in cooling until 10 ”/hg *(0.69 BAR)* of vacuum is reached. Shut the system down and tag out system power source.

e. Frontseat the compressor discharge service valve and wait 5 minutes to verify vacuum is maintained. If the pressure rises above vacuum, open the compressor discharge service valve and repeat steps c and d until a vacuum is maintained.

f. Service or replace components as required and leak check the compressor.

g. Using refrigerant hoses designed for vacuum service, connect a vacuum pump to center connection of manifold gauge set. Evacuate system to 500 microns. Close off pump valve, isolate vacuum gauge and stop pump. Wait 5 minutes to verify that vacuum holds.

h. Once vacuum is maintained, backseat compressor service valves and disconnect manifold gauge set.

i. Reconnect the suction pressure transducer (SPT).

j. Clear the low pressure alarm. (Refer to paragraph 2.1.6)

4.5 REFRIGERANT LEAK CHECK

A refrigerant leak check should always be performed after the system has been opened to replace or repair a component.

To check for leaks in the refrigeration system, perform the following procedure:

NOTE

It must be emphasized that only the correct refrigerant drum should be connected to pressurize the system. Any other gas or vapor will contaminate the system, which will require additional evacuation.

a. Ensure all the service valves and solenoid valves are open. It will be necessary to energize the solenoid valves from an external power source.

b. If the system is without refrigerant, charge the system with refrigerant vapor to build up pressure between 30 to 50 psig *(2.74 to 3.40 BAR)*.

c. Add sufficient nitrogen to raise system pressure to a maximum of 150 psig *(10.21 BAR)*.

d. Check for leaks. It is recommended that an electronic leak detector be used to find refrigerant leaks in a system. Testing joints with soapsuds is satisfactory and may be necessary under conditions when an electronic leak detector will not function correctly.

e. Remove refrigerant from system and repair any leaks.

f. Evacuate and dehydrate the system. (Refer to paragraph 4.6)

g. Charge the unit. (Refer to paragraph 4.7)

h. Ensure that self-test has been performed and that there are no errors or alarms indicated. (Refer to paragraphs 2.1.5 and 2.1.6)

4.6 EVACUATION AND DEHYDRATION

4.6.1 General

The presence of moisture in a refrigeration system can have many undesirable effects. The most common are copper plating, acid sludge formation, "freezing-up" of metering devices by free water, and formation of acids, resulting in metal corrosion.

4.6.2 Preparation

NOTE

1. Using a compound gauge for determination of vacuum level is not recommended because of its inherent inaccuracy.

2. Never evacuate an open drive compressor below 500 microns.

a. Evacuate and dehydrate only after pressure leak test. (Refer to paragraph 4.5)

b. Essential tools to properly evacuate and dehydrate any system include a good vacuum pump with a minimum of 6 cfm *(10.2 m^3/hr)* volume displacement, (CTD P/N 07-00176-11), and a good digital (micron) vacuum indicator (CTD P/N 07-00414-00).

c. Keep the ambient temperature above 60°F *(15.6°C)* to speed evaporation of moisture. If ambient temperature is lower than 60°F *(15.6°C)*, ice may form before moisture removal is complete. It may be necessary to use heater blankets, heat lamps or alternate sources of heat to raise system temperature.

4.6.3 Procedure for Evacuation and Dehydrating System

a. Remove refrigerant using a refrigerant recovery system. (CTD P/N MVS-115-F-L-CT for 115 volt power source or CTD P/N MVS-240-F-L-CT for 240 volt power source)

b. The recommended method is connecting two lines (3/8" OD copper tubing or refrigerant hoses designed for vacuum service) to the manifold guage set. Attach one line to the condenser service (King) valve and the other line to the evaporator service port. (See Figure 4-4)

c. Connect lines to unit and manifold and make sure vacuum gauge valve is closed and vacuum pump valve is open.

d. To speed up evacuation time, open solenoid valves electrically. An additional vacuum pump may be added and connected to the compressor suction service port. (See Figure 4-4)

e. Start vacuum pump. Slowly open valves halfway and then open vacuum gauge valve.

f. Evacuate unit until vacuum gauge indicates 1500 microns vacuum. Close gauge valve, vacuum pump valve, and stop vacuum pump.

g. Break the vacuum with clean dry refrigerant or dry nitrogen. Use the refrigerant that the unit calls for. Raise system pressure to approximately 2 psig *(0.14 BAR)*.

h. Remove refrigerant using a refrigerant recovery system, or if using nitrogen vent to atmosphere.

i. Start vacuum pump and open all valves. Evacuate unit to 500 microns vacuum.

j. Close off pump valve, isolate vacuum gauge in system and stop pump. Wait five minutes to see if vacuum holds.

k. With a vacuum still in the unit, the refrigerant charge may be drawn into the system from a refrigerant container on weight scales. (Refer to paragraph 4.7)

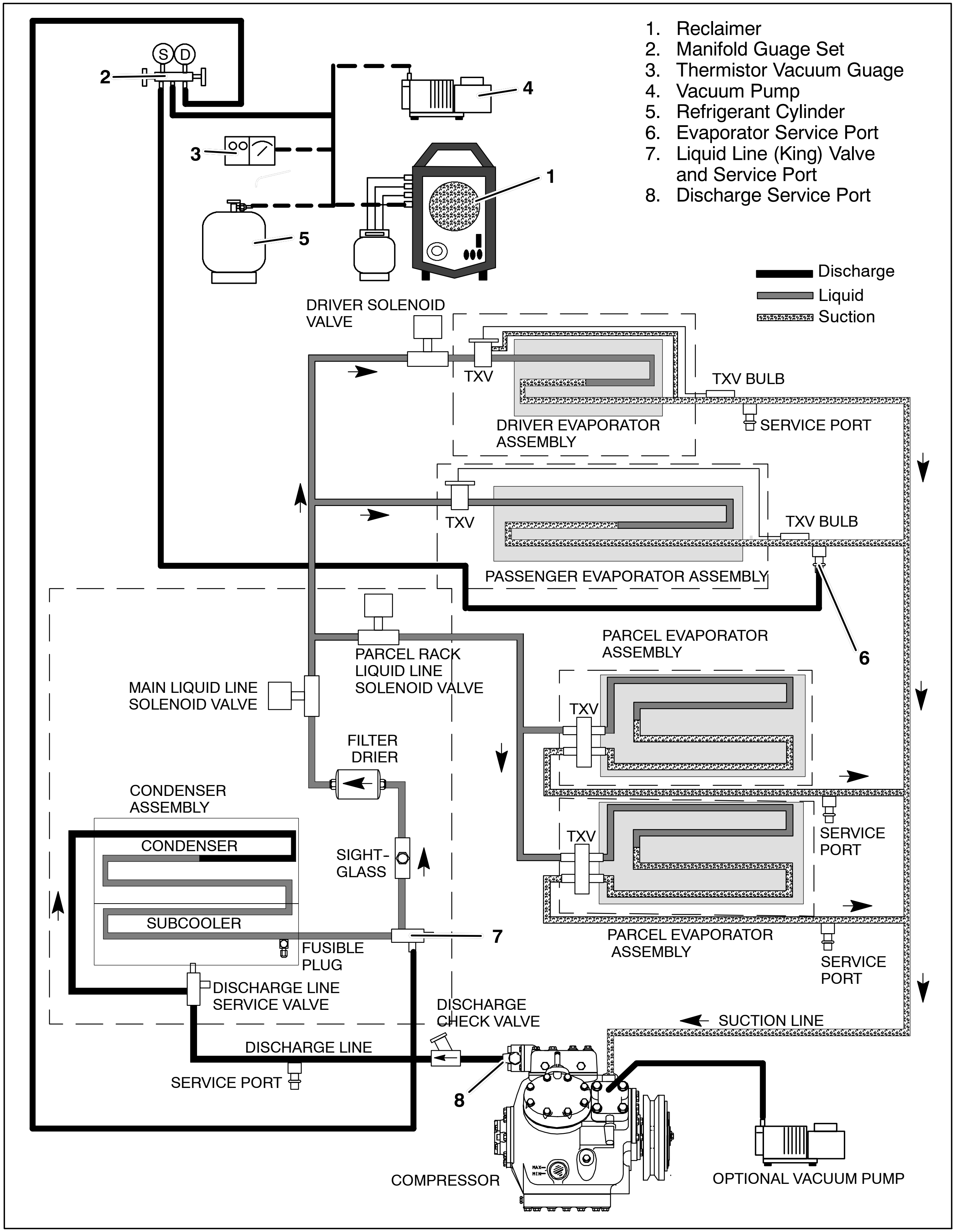


Figure 4-4. Refrigerant Service Connections

4.7 ADDING REFRIGERANT TO SYSTEM

4.7.1 Checking Refrigerant Charge

a. Connect an accurate high pressure gauge to the discharge service port at the compressor. (See Figure 4-4)

b. The condenser coil should be clean and free of any debris.

c. Coach engine operating at high idle (800-1000RPM).

d. The compressor should be fully loaded (six cylinder operation).

e. Unit must be operating in the cool mode until the discharge pressure has stabilized (3 to 5 minutes) and the interior temperature is between 70 and 80°F (21.1 and 26.7°C).

f. Discharge pressure at least 150 psig *(10.21 BAR)* and stable for R-134a systems (It may be necessary to partially block condenser airflow to raise discharge pressure).

g. Observe the Liquid Line Sight Glass and use the following chart to determine the condition of the refrigerant charge:

Table 4-1. Checking Refrigerant Charge

Sight Glass Observation	Condition
Liquid present Clear of all bubbles	Good/Possible over charge - Continue to step i.
Liquid present Occasional bubbles present	Good
Liquid present Many bubbles present	Possible under charge - Continue to step i.

h. If the conditions in steps b. thru f. are met and there is still doubt about the refrigerant charge level use Table 4-2:

Table 4-2. Checking Refrigerant Charge

Condenser Inlet Air Temperature		Discharge Pressure Range	
°F	°C	PSIG	BAR
60	16	110-135	7.48-9.19
65	18	120-145	8.16-9.87
70	21	130-155	8.85-10.55
75	24	140-165	9.53-11.23
80	27	150-175	10.21-11.91
85	29	160-186	10.89-12.66
90	32	175-200	11.91-13.61
95	35	190-212	12.93-14.42

i. With an accurate temperature gauge, measure the condenser inlet air temperature.

NOTE

Do not use a temperature gun as it measures surface temperature and not air temperature.

1. If the actual discharge pressure is higher than the discharge pressure range, the system may be over charged.
2. If the actual discharge pressure is lower than the discharge pressure range, the system may be under charged.
3. If the actual discharge pressure is in the discharge pressure range, the system charge is adequate.

NOTE

Many system related problems will effect system pressures. Use Table 3-5 **General System Troubleshooting Procedures** to determine other possible causes before adding or removing refrigerant.

4.7.2 Adding Full Charge

a. Evacuate and dehydrate system. (Refer to paragraph 4.6.)

b. Place appropriate refrigerant cylinder on scales and connect charging hose from container to filter-drier inlet valve. Remove air from hoses.

c. Note weight of refrigerant and container.

d. Open liquid valve on refrigerant container. Midseat filter-drier inlet valve and allow refrigerant to flow into the unit. Refer to paragraph 1.3 for correct charge.

e. When drum weight (scale) indicates that the correct charge has been added, close liquid line valve on drum and backseat the filter-drier inlet valve.

4.7.3 Adding Partial Charge

NOTE

Refrigerant charge is critical, when adding charge to the unit do not add any more charge to the system after bubbles have been eliminated from the sight glass.

a. Start the vehicle engine and allow the system to stabilize. (Refer to 4.7.1a. to f.)

b. Connect charging hose from appropriate refrigerant cylinder vapor valve to compressor suction service valve.

c. Open cylinder valve and add vapor charge. Under the above conditions, the system is properly charged when the condenser sight glass is clear with occasional bubbles showing. Add or remove refrigerant until the proper charge is obtained.

d. Backseat suction service valve. Close vapor valve on refrigerant drum. Replace all valve caps.

4.8 CHECKING FOR NONCONDENSIBLES

To check for noncondensibles, proceed as follows:

a. Stabilize system to equalize pressure between the suction and discharge side of the system. The engine needs to be off for several hours.

b. Measure temperature at any of the copper tubing in the condenser.

c. Check pressure at the compressor discharge service valve.

d. Determine saturation pressure as it corresponds to the condenser temperature using the Temperature-Pressure Chart, Table 4-6.

e. If gauge reading is 3 psig *(.2 BAR)* or higher than the calculated P/T pressure in step d, noncondensibles are present.

f. Remove refrigerant using a refrigerant recovery system. (Refer to paragraph 4.6.3)

g. Evacuate and dehydrate the system. (Refer to paragraph 4.6)

h. Charge the unit. (Refer to paragraph 4.7)

4.9 CHECKING AND REPLACING HIGH PRESSURE CUTOUT SWITCH

4.9.1 Replacing High Pressure Switch

a. The high pressure switch is equipped with schrader valve to allow removal and installation without pumping the unit down.

b. Unplug the wiring from the switch.

c. Check switch operation. (Refer to paragraph 4.9.2)

d. Replace switch if it does not function as outlined below. (Refer to paragraph 4.9.2)

4.9.2 Checking High Pressure Switch

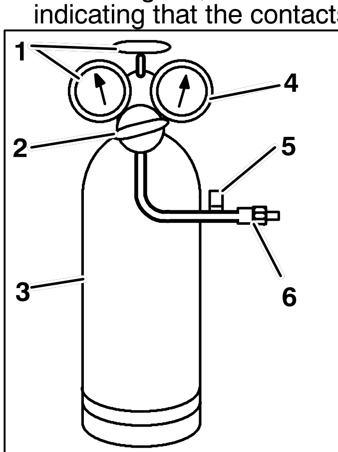
WARNING

DO NOT USE A NITROGEN CYLINDER WITHOUT A PRESSURE REGULATOR

DO NOT USE OXYGEN IN OR NEAR A REFRIGERATION SYSTEM AS AN EXPLOSION MAY OCCUR.

a. Remove switch from unit. All units are equipped with schrader valves at the high pressure switch connection.

b. Connect an ohmmeter across switch terminals. If the switch is good, the ohmmeter will indicate continuity, indicating that the contacts are closed.



1. Cylinder Valve and Gauge
2. Pressure Regulator
3. Nitrogen Cylinder
4. Pressure Gauge, 0 to 400 psig *(0 to 2.8 mPa)*
5. Bleed-Off Valve
6. 1/4 inch Connection

Figure 4-5. Checking High Pressure Switch

c. Connect switch to a cylinder of dry nitrogen. (See Figure 4-5)

d. Set nitrogen pressure regulator higher than cutout point on switch being tested. (Refer to paragraph 1.3)

e. Open cylinder valve. Slowly open the regulator valve to increase the pressure until it reaches cutout point. The switch should open, which is indicated by an infinity reading on an ohmmeter (no continuity).

f. Close cylinder valve and release pressure through the bleed-off valve. As pressure drops to cut-in point, the switch contacts should close, indicating continuity on the ohmmeter.

4.10 FILTER-DRIER

4.10.1.To Check Filter Drier

Check for a restricted or plugged filter-drier by feeling the liquid line inlet and outlet connections of the filter-drier. If the outlet side feels cooler than the inlet side, then the filter-drier should be changed.

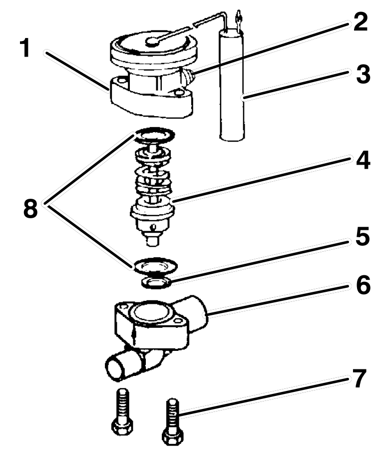
4.10.2.To Replace Filter Drier

a. Pump down the unit. (Refer to paragraph 4.4)

b. Replace filter-drier, ensuring that the arrow points in the direction of the refrigerant flow.

c. Drier can be evacuated at liquid line service valve. (See Figure 4-4)

d. Check refrigerant charge. (Refer to paragraph 4.7.1)



1. Power Head Assembly
2. Equalizer Connection
3. Bulb
4. Cage Assembly
5. Seat Gasket
6. Body Flange
7. Capscrew
8. Body Flange Gasket

Figure 4-6. Thermostatic Expansion Valve

4.11 THERMOSTATIC EXPANSION VALVE

The thermostatic expansion valve (TXV) is an automatic device which maintains constant superheat of the refrigerant gas leaving the evaporator regardless of suction pressure. The valve functions are: (a) automatic response of refrigerant flow to match the evaporator load and (b) prevention of liquid refrigerant returning to the compressor. Unless the valve is defective, it seldom requires any maintenance. All TXV's are non-adjustable.

4.11.1 Replacing the Expansion Valve (See Figure 4-6)

a. Pump down low side of the unit. (Refer to paragraph 4.4)

b. Remove insulation (Presstite) from expansion valve bulb.

c. Loosen retaining straps holding bulb to suction line and detach bulb from the suction line.

d. Loosen flare nut on equalizer line and disconnect equalizer line from the expansion valve.

e. Remove capscrews and lift off power head and cage assemblies and gaskets.

f. Check, clean and remove any foreign material from the valve body, valve seat and mating surfaces.

NOTE

Do not adjust the new replacement expansion valve. Valves are preset at the factory.

g. Using new gaskets, install new cage and power head assemblies provided with repair kit.

h. The thermal bulb is installed below the center of the suction line (four or eight o'clock position). This area must be clean to ensure positive bulb contact. Strap thermal bulb to suction line and insulate both with "Presstite." Ensure that retaining straps are tight. (See Figure 4-7)

i. Connect equalizer line to the expansion valve.

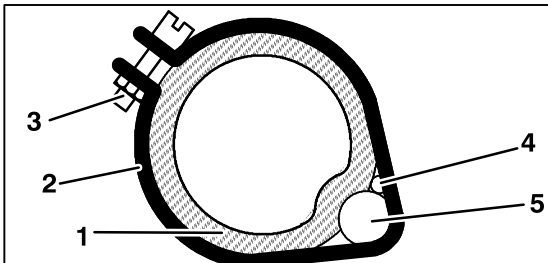
j. Evacuate and dehydrate. (Refer to paragraph 4.6)

k. Open filter-drier inlet valve (liquid line service valve) and all service valves.

l. Run the coach for approximately 30 minutes on fast idle.

m. Check refrigerant charge. (Refer to paragraph 4.7.1)

n. Check superheat. (Refer to paragraph 4.11.2)



1. Suction Line (end view)
2. TXV Bulb Clamp
3. Nut and Bolt (clamp)
4. Thermocouple
5. TXV Bulb (Shown in the four o'clock position)

Figure 4-7. Thermostatic Expansion Valve Bulb and Thermocouple Installation

4.11.2 To Check/Measure Superheat

NOTE

All readings must be taken from the leaving side of the evaporator.

a. Open filter access door.

b. Remove Presstite insulation from expansion valve bulb and suction line.

c. Loosen one TXV bulb clamp and make sure area under clamp (above TXV bulb) is clean.

d. Place temperature thermocouple in contact with the suction tube and parallel to the TXV bulb, and then secure loosened clamp making sure both bulbs are firmly secured to suction line. (See Figure 4-7) Reinstall insulation around the bulb.

e. Connect an accurate low pressure gauge (or install a manifold gauge set) to the service port on the leaving side of the evaporator. (Refer to paragraph 4.3)

f. Close evaporator access door being careful to route thermocouple sensing wire and guage hose thru the access hole to outside the evaporator.

g. Start coach and run on fast idle until unit has stabilized, about 20 to 30 minutes.

h. From the temperature/pressure chart, determine the saturation temperature corresponding to the evaporator outlet pressure. (Refer to Table 4-6)

i. Note the temperature of the suction gas at the expansion valve bulb. Subtract the saturation temperature determined in step 8 from the temperature measured in this step. The difference is the superheat of the suction gas.

j. Repeat steps 8. and 9. six times at three minute intervals and average the six readings to determine average superheat. Average superheat should be 12 to 18°F *(6.7 to 10.1°C)*.

4.12 MODEL 05G COMPRESSOR MAINTENANCE

4.12.1 Removing the Compressor

If compressor is inoperative and the unit still has refrigerant pressure, isolate the compressor and remove the refrigerant. (Refer to paragraph 4.4.3)

If compressor is operative, perform a pump down. (Refer to paragraph 4.4.4)

a. Turn main battery disconnect switch to OFF position and lock.

b. Loosen the compressor drive belt, and remove.

c. Loosen bolts at suction and discharge service valve flanges and break seal to be sure pressure is released.

d. Remove bolts from suction and discharge service valve flanges.

e. Tag and disconnect wiring to the high pressure cutout switch, discharge pressure transducer, suction pressure transducer, unloaders and the clutch.

f. Remove four bolts holding compressor to base.

g. Attach sling or other device to the compressor and remove compressor from the coach through the right rear access door.

h. Set the compressor on a sturdy work surface.

4.12.2 Re-installing the Compressor

NOTES

1. The service replacement 05G compressors are sold without shutoff valves. Valve pads are installed in their place. The optional unloaders are not supplied, as the cylinder heads are shipped with plugs. The customer should retain the original unloader valves for use on the replacement compressor.

2. The piston plug that is removed from the replacement compressor head must be installed in the failed compressor if returning for warranty.

3. Do not interchange allen head capscrews that mount the piston plug and unloader; they are not interchangeable.

4. Check oil level in service replacement compressor. (Refer to paragraphs 1.3 and 4.12.4)

5. Service replacement compressors are supplied with a suction filter sock for initial startup. Ensure the filter sock is installed and removed in accordance with the instructions furnished.

a. Remove the three socket head capscrews from both unloader valves on the side heads of the 05G compressor. Remove the unloader valve and bypass piston assembly, keeping the same capscrews with the assembly. (See Figure 4-8) The original unloader valve must be transferred to the replacement compressor. The plug arrangement removed from the replacement is installed in the original compressor as a seal. If piston is stuck, it may be extracted by threading a socket head capscrew into top of piston. A small Teflon seat ring at the bottom of the piston must be removed.

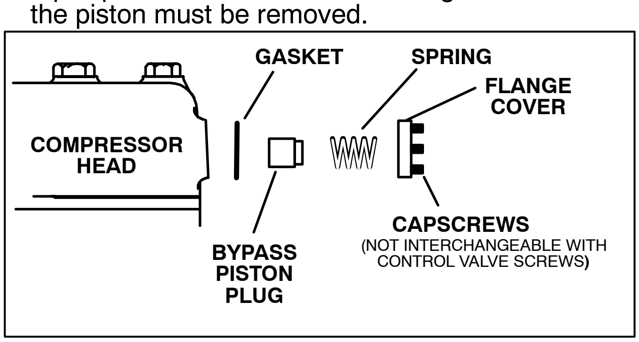


Figure 4-8. Removing Bypass Piston Plug

b. Remove the high pressure switch and pressure transducer assemblies and install on replacement compressor after checking switch operation.

c. Install compressor in unit by performing steps c. through g. in reverse sequence. It is recommended that new locknuts be used when replacing compressor. Install new gaskets on service valves and tighten bolts uniformly.

d. Re-install and tension the compressor drive belt.

e. Unlock and turn main battery disconnect switch to ON position..

f. Attach two lines (with hand valves near vacuum pump) to the suction and discharge service valves.

g. Fully backseat (open counterclockwise) both suction and discharge service valves.

h. Remove vacuum pump lines and install manifold gauges.

i. Start unit and check refrigerant level. (Refer to paragraph 4.7.1)

j. Check compressor oil level. (Refer to paragraph 4.12.4) Add or remove oil if necessary.

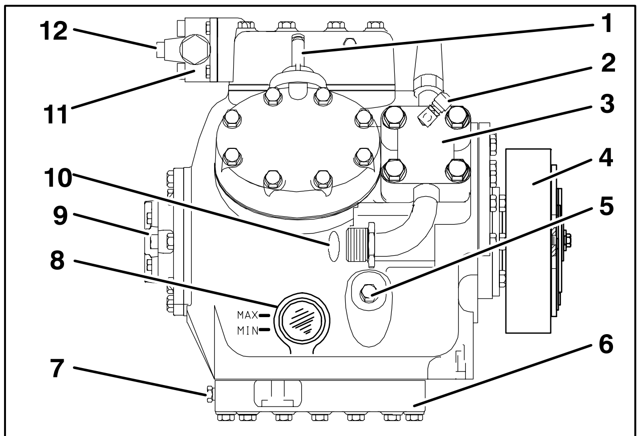
k. Check compressor unloader operation.

4.12.3 Compressor Unloaders

Although the electric unloaders are non-adjustable, they will require some periodic maintenance. Service kits are available for repair of the electric unloaders solenoid and stem assemblies.

To check the unloaders proceed as follows:.

a. Ensure that the compressor is fully loaded. Heat the interior of the coach if necessary.



1. Electric Unloader Valve
2. Suction Service Valve Charging Port
3. Suction Service Valve
4. Clutch
5. Oil Fill Plug
6. Bottom Plate
7. Oil Drain Plug
8. Oil Level Sight Glass
9. Oil Pump
10. O'Ring
11. Discharge Service Valve
12. Service Port

Figure 4-9. Model O5G Compressor

b. Connect manifold guages to the compressor.

c. Slowly frontseat the suction valve until 26 psig shows on the suction guage. The first unloader should energize (check for magnetism at the unloader coil) increasing suction pressure by 3 to 5 psig.

d. Slowly open the suction valve until the suction gauge reads 32 psig. The first unloader should de-energize decreasing suction pressure by 3 to 5 psig to show it is operating properly.

e. To check the second unloader, continue to frontseat the suction valve until 21 psig shows on the suction guage. The second unloader should energize (check for magnetism at the unloader coil) increasing suction pressure by 3 to 5 psig.

f. Slowly open the suction valve until the suction guage reads 28 psig. The first unloader should de-energize decreasing suction pressure by 3 to 5 psig to show it is operating properly.

g. Back seat the suction service valve, remove the guage(s) to resume normal operation.

4.12.4 Compressor Oil Level

NOTE

The compressor should be fully loaded (six cylinder operation); the unit should be fully charged and the compressor crankcase should be warm to the touch.

a. Start the unit and allow the system to stabilize.

b. Check the oil sight glass on the compressor to ensure that no foaming of oil is present after 20 minutes of operation. If oil is foaming excessively after 20 minutes of operation, check the refrigerant system for flood-back of liquid refrigerant. Correct this situation before proceeding.

c. Check the level of oil in oil level sight glass immediately after shutting down the compressor. The lowest level visible should be at the bottom of the sightglass and the highest level should be at the middle of the sight glass. (See Figure 4-9)

4.12.5 Adding Oil with Compressor in System

Two methods for adding oil are: the oil pump method and closed system method.

NOTE

Special care must be taken when working with POE oil that is used with HFC refrigerants such as R-134a, as POE oil is very hygroscopic. (POE oil will easily absorb water.) Do not leave POE oil containers open to the atmosphere.

4.12.5.1. Oil Pump Method

a. One compressor oil pump that may be purchased is a Robinair part no. 14388. This oil pump adapts to one U.S. gallon *(3.785 liters)* metal refrigeration oil container and pumps 2-1/2 ounces *(72.5 milliliters)* per stroke when connected to the suction service valve port. Also, there is no need to remove pump from can after each use.

b. When the compressor is in operation, the pump check valve prevents the loss of refrigerant while allowing servicemen to develop sufficient pressure to overcome the operating suction pressure to add oil, as necessary.

c. Backseat suction service valve and connect oil charging hose to port. Crack open the service valve and remove air from the oil hose at the oil pump. Add oil as necessary.

NOTE

Allow time (at least 60 seconds) for the oil to flow thru to the crankcase and show on the sightglass.

4.12.5.2. Closed System Method

a. Install manifold gauge set. (See Figure 4-3)

b. Unplug the suction pressure transducer (SPT).

c. Frontseat the compressor suction service valve by turning clockwise.

d. Start the unit and run in cooling until 10 "/hg (25.4 cm/hg) of vacuum is reached. Shut the system down and tag out system power source.

e. Frontseat the compressor discharge service valve and wait 5 minutes to verify vacuum is maintained.

f. Remove the crankcase oil fill plug on the side of the crankcase.

g. Replace the crankcase oil fill plug with a Carrier Service Parts no. OTBO889 fitting. This fitting has a 1/4 inch flare access port with a shrader valve.

h. Using refrigerant hoses designed for vacuum service, connect a vacuum pump to center connection of manifold gauge set.

CAUTION

Care Must Be Taken To Ensure That The Manifold Common Connection Remains Immersed In Oil At All Times Or Air And Moisture Will Be Drawn Into The System.

i. Connect a refrigerant hose with a shrader depressor to the fitting described in step g. above, put the other end of the hose in a fresh oil container.

j. Evacuate the compressor and observe the oil level in the compressor crankcase. When the desired oil level is reached, disconnect the hose from the fitting.

k. Reinstall the crankcase oil fill plug.

l. Using refrigerant hoses designed for vacuum service, connect a vacuum pump to center connection of manifold gauge set. Evacuate system to 500 microns. Close off pump valve, isolate vacuum gauge and stop pump. Wait 5 minutes to verify that vacuum holds.

m. Once vacuum is maintained, backseat compressor service valves and disconnect manifold gauge set.

n. Reconnect the suction pressure transducer(SPT).

4.12.6 Adding Oil to Service Replacement Compressor

Service replacement compressors may or may not be shipped with oil.

If the replacement compressor is shipped without oil, add oil through the oil fill plug. (See Figure 4-9)

4.12.7 Removing Oil from the Compressor:

a. If the lowest oil level observed in paragraph 4.12.4, step c., is above middle of the sight glass on compressor crankcase, oil must be removed from the compressor by performing the following procedure. If lowest oil level visible is below bottom of the sightglass, oil must be added to the compressor by following the procedure in paragraph 4.12.5.

b. Close (frontseat) suction service valve and pump unit down to 3 to 5 psig *(21 to 34 kPa).* Reclaim remaining refrigerant.

NOTE

If oil drain plug is not accessible, it will be necessary to extract oil through the oil fill plug with a siphon tube.

WARNING

EXTREME CARE MUST BE TAKEN TO ENSURE THAT ALL THE REFRIGERANT HAS BEEN REMOVED FROM THE COMPRESSOR CRANKCASE OR THE RESULTANT PRESSURE WILL FORCIBLY DISCHARGE COMPRESSOR OIL.

c. Remove the oil drain plug on the bottom plate of the compressor and drain the proper amount of oil from the compressor. Replace the plug securely back into the compressor.

d. Repeat step a. to ensure proper oil level.

Table 4-3. Temperature Sensor (AT, TSC, TSD and TSR) Resistance

Temperature		Resistance In Ohms
°F	°C	
-20	-28.9	165,300
-10	-23.3	117,800
0	-17.8	85,500
10	-12.2	62,400
20	- 6.7	46,300
30	- 1.1	34,500
32	0	32,700
40	4.4	26,200
50	10.0	19,900
60	15.6	15,300
70	21.1	11,900
77	25	10,000
80	26.7	9,300
90	32.2	7,300
100	37.8	5,800
110	43.3	4,700
120	48.9	3,800

4.13 TEMPERATURE SENSOR CHECKOUT

a. An accurate ohmmeter must be used to check resistance values shown in Table 4-3.

b. Due to variations and inaccuracies in ohmmeters, thermometers or other test equipment, a reading within two percent of the chart value would be considered good. If a sensor is bad, the resistance value would usually be much higher or lower than the value given in the Table 4-3.

NOTE

This system is equipped with three temperature sensors, two located in the return air ducts inside the coach, the third sensor is located in the condenser section. The two inside sensors are wired in parallel and together send an averaged signal to the controller. If one of these sensors fails the control function will continue with the remaining sensor. The sensor located in the condenser section reads outdoor temperature.

4.14 HUMIDITY SENSOR CHECKOUT

a. Use a sling psychrometer or similar device to check relative humidity inside the coach.

NOTE

System can be shut down but 5 vdc power must be applied to the humidity sensor to enable checking.

b. Measure voltage across the sensor and compare to values in Table 4-4 for the measured relative humidity. A reading within two percent of the values in the table would be considered good.

c. At least one sensor lead must be disconnected from the controller before any reading can be taken. Not doing so will result in a false reading. Two preferred methods of determining the actual test temperature at the sensor are an ice bath at 32°F *(0°C)* and/or a calibrated digital temperature meter.

d. If the driver display indicates that temperature at sensor is -40°F *(-40°C)*, sensor could be open. If driver display indicates that temperature at sensor is 127°F *(52.8°C)*, sensor could be shorted.

Table 4-4. Humidity Sensor (HS) Voltage

%RH	Voltage	%RH	Voltage	%RH	Voltage
30	0.990	55	1.815	80	2.640
35	1.155	60	1.980	85	2.805
40	1.320	65	2.145	90	2.970
45	1.485	70	2.310	95	3.168
50	1.650	75	2.475		

4.15 SUCTION AND DISCHARGE PRESSURE TRANSDUCER CHECKOUT

NOTE

1. System must be operating to check transducers.
2. Both transducers are mounted on the compressor

a. With the system running, use the driver display or manifold gauges to check suction and/or discharge pressure(s).

b. Use a digital volt-ohmmeter to measure voltage across the transducer and compare to values in Table 4-5. A reading within two percent of the values in the table would be considered good.

Table 4-5. Suction and Discharge Pressure Transducer (SPT and DPT) Voltage

Psig	Voltage	Psig	Voltage	Psig	Voltage
20”	0.369	105	1.495	220	2.622
10”	0.417	110	1.544	225	2.671
0	0.466	115	1.593	230	2.720
5	0.515	120	1.642	235	2.769
10	0.564	125	1.691	240	2.818
15	0.614	130	1.740	245	2.867
20	0.663	135	1.789	250	2.916
25	0.712	140	1.838	255	2.965
30	0.761	145	1.887	260	3.014
35	0.810	150	1.936	265	3.063
40	0.858	155	1.985	270	3.112
45	0.907	160	2.034	275	3.161
50	0.956	165	2.083	280	3.210
55	1.007	170	2.132	285	3.259
60	1.054	175	2.181	290	3.308
65	1.103	180	2.230	295	3.357
70	1.152	185	2.279	300	3.406
75	1.204	190	2.328	305	3.455
80	1.250	195	2.377	310	3.504
85	1.299	200	2.426	315	3.553
90	1.348	205	2.475	320	3.602
95	1.397	210	2.524	325	3.651
100	1.446	215	2.573	330	3.700

4.16 REPLACING SENSORS AND TRANSDUCERS

a. Turn main battery disconnect switch to OFF position and lock.

b. Tag and disconnect wiring from defective sensor or transducer.

c. Remove and replace defective sensor or transducer.

d. Connect wiring to replacement sensor or transducer.

e. Checkout replacement sensor or transducer. (Refer to paragraph 4.13, 4.15 or 4.14, as applicable.)

4.17 SERVICING MAIN EVAPORATOR BLOWER ASSEMBLY

a. Turn main battery disconnect switch to OFF position and lock.

b. Remove access door located in the #3 baggage compartment. To remove the access door, unlatch, then open the door enough to slide the hinge pins out of the pin brackets.

c. Disconnect electrical connections to the motor.

d. Remove blower transitions ducts.

e. Remove the four bolts securing the evaporator motor mounting plate, motor and blower housing assembly to the bottom panel.

f. Remove motor and blower wheel assembly by sliding out of evaporator housing.

g. Repair or replace any defective component(s), as required.

h. Replace by reversing steps b. thru f.

4.18 ACCESSING MAIN EVAPORATOR MOTOR BRUSHES

a. Turn main battery disconnect switch to OFF position and lock.

b. Remove access door. (Refer to 4.17.b.)

c. Disconnect electrical connections to the motor.

d. With a marker, trace the outline of the motor on the motor plate.

e. Remove the four brush access doors on the motor.

f. Service two brushes (top front and top rear).

g. Remove the four bolts securing the evaporator motor to the mounting plate.

h. Rotate the motor to gain access to the lower front brush.

i. Rotate the motor the opposite way to gain access to the lower rear brush.

j. Rotate the motor back to its feet and position back to its original position guided by the outline drawn in step d.

k. Re-secure the motor with the four bolts removed in step g. Check fan rotation, insuring that the fan wheels do not make contact with the fan housings.

l. Complete the procedure by performing steps a. thru c. in reverse.

4.19 SERVICING MOTOR BRUSHES

If the brushes are broken, cracked, severely chipped, or worn to 1/3 their original length, replace them.

a. Remove the four brush access doors on the motor.

b. With fingers or a suitable hook, lift the brush spring end up so the brush may slide up and out of the holder. Loosen the brush screw to remove the brush shunt terminal. Remove the brush.

c. To replace, lift the brush spring and place the brush in the holder. Position the end of the spring on top of the brush.

d. Connect the brush shunt terminal to its proper crossover with the brush screw assembled loosely.

NOTE

Assure positioning of the brush to permit the brush shunt to travel freely in the holder slot as the brush wears. If the brush hangs up, commutator damage and motor failure will result

e. Tighten screw.

4.20 SERVICING THE MAIN EVAPORATOR AND HEATER COIL

a. Drain engine coolant from the heater coil.

b. Pump down low side of the HVAC system. (Refer to paragraph 4.4.1.)

c. Remove remaining refrigerant. (Refer to paragraph 4.4.)

d. Remove the evaporator motor by following paragraph 4.17 steps a. thru f.

e. Disconnect all remaining electrical connections, move wires out of the way.

f. Remove the evaporator electrical panel assembly.

g. Remove the liquid line (3 connection points) and the discharge line (2 connection points) that pass thru the evaporator and connect to the evaporator.

h. Disconnect and remove the suction line.

i. Disconnect and remove the heater hoses.

j. Remove the door frame surrounding the evaporator enclosure.

k. Remove the four bolts that secure the coil bracket to the drain pan. Leave the coil bracket bolted to the evaporator coil until the coil has been removed from the coach.

WARNING

WHEN MOVING THE COIL CARE MUST BE TAKEN TO AVOID PERSONAL INJURY BECAUSE OF THE WEIGHT OF THE COIL.

l. Brace the top of the coil hold it in position.

m. Remove the four bolts that secure the top of the coil to the evaporator housing.

n. Rotate the top of the coil till the coil is horizontal and slide out of the evaporator housing.

o. Re-install by performing the above procedure in reverse.

4.21 REMOVING THE CONDENSER ASSEMBLY

a. Remove two side access panels from rear of the last baggage bay.

b. Remove and reclaim the entire refrigerant charge. (Refer to paragraph 4.4.2.)

c. Turn main battery disconnect switch to OFF position and lock.

d. Disconnect all electrical leads to the module.

e. Disconnect refrigerant lines to the module.

f. Remove the door latch stud to the right side of the condenser compartment.

g. Remove the front panel and the eight screws fastening the condenser to the coach.

h. Remove the stabilizing bracket on the top of the condenser.

i. Remove the eight screws securing the condenser door hinges to the frame.

j. Remove condenser module by sliding out on mounting rails.

4.22 SERVICING THE CONDENSER COIL

a. Remove the condenser assembly from the coach. (Refer to paragraph 4.21)

b. Remove side panel (with control box).

c. Remove front shroud and panel assemblies.

d. Unbraze coil/tubing connections and roll front module assembly forward to provide clearance for coil removal.

e. Remove condenser coil.

f. Repair or replace the condenser coil.

g. Re-install by performing the above procedure in reverse.

4.23 SERVICING THE CONDENSER MOTOR

a. Turn main battery disconnect switch to OFF position and lock.

b. Remove appropriate front condenser grill.

c. Remove fan blade, secure the shaft key to the motor shaft or fan hub slot.

d. Disconnect the wires to the motor.

e. Remove the four motor base mounting screws.

f. Remove the motor and place on workbench.

g. Repair or replace defective component(s), as required.

h. For brush inspection/replacement refer to paragraph 4.19.

i. Re-install by performing the above procedure in reverse.

4.24 SERVICING THE DRIVER CONTROL BOX

The driver control box is located behind the return air panel below the passenger side dash and under the right headlight. (See Figure 4-10.) Remove the return air panel by removing the eight screws holding the panel in place. Remove and service the control box by performing the following procedure:

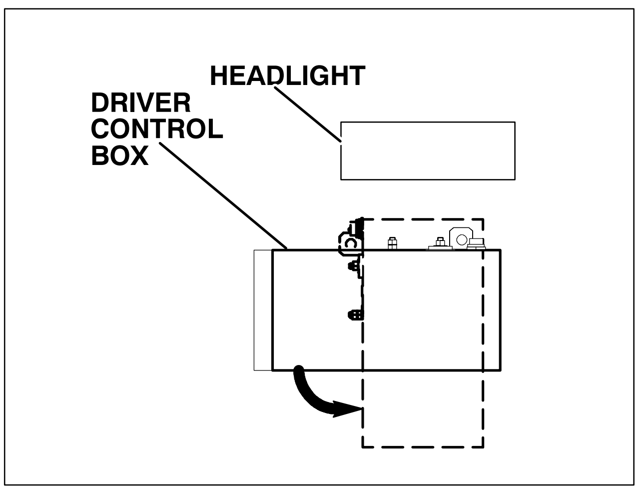


Figure 4-10. Removing Driver Control Box

a. Turn main battery disconnect switch to OFF position and lock.

b. Remove the power wire from the power stud and the connector from the box.

c. Remove the 1/4-inch capscrew at the upper right cover of the box. Pull the box laterally approximately 3/4-inch to the right to remove it from the pocket.

d. Rotate box counterclockwise 90 degrees as shown in Figure 4-10 and carefully lift the box out.

e. Repair or replace defective components, as necessary.

f. Re-install the driver control box by reversing the above procedure.

4.25 SERVICING THE DRIVER EVAPORATOR

4.25.1 Access Cover Removal

a. Remove stepwell access cover and disconnect 2-inch flex hose adapter.

b. Using a flat screwdriver, unfasten three 1/4 turn fasteners from access cover on driver evaporator assembly.

c. Open driver storage compartment and remove plug in sheet metal.

d. With screwdriver, unfasten the last 1/4 turn fastener.

e. Draw access cover towards the rear and slide to the right.

4.25.2Blower Removal

a. Disconnect plugs and speed control from the blower.

b. Undo latch and push the blower towards the rear.

c. Drop the blower down and remove.

4.25.3 Air filter Removal

a. With the access cover removed, slide right hand side air filter towards center and turn right corner past edge.

b. Slide left hand side filter to the right and repeat as above.

c. Clean/replace filter and re-install.

4.25.4 Removal of Evaporator/Heater Coil Assembly

a. Clamp off silicon hose close to the input and output end of the heater core.

b. Disconnect hose clamps and separate hose from fitting.

c. Pump down the refrigerant system. (Refer to paragraph 4.4.1)

d. Disconnect liquid line solenoid valve plug.

e. Disconnect expansion valve thermal bulb attached to the 7/8-inch copper tube.

f. Disconnect 7/8 and 3/8-inch copper lines.

g. Remove screws that attach the heater core to the unit.

h. Lift evaporator coil up and pull towards the rear for removal.

4.25.5 RAM Air Actuator Removal

a. Disconnect the plug.

b. Remove the no. 10 screw from the end of the spring on the RAM air actuator.

4.26 SERVICING THE PARCEL RACK EVAPORATOR

4.26.1 Motor Removal

a. Disconnect the motor wires from the connector.

b. Remove the two bolts from the motor mount and remove the motor.

c. Remove the blower and motor assembly.

4.26.2 Removal of Parcel Rack Evaporator Coil

a. Pump down the refrigerant system. (Refer to paragraph 4.4.1)

b. Remove the side access panel.

c. Disconnect expansion valve thermal bulb attached to the 7/8-inch copper tube.

d. Disconnect 7/8 and 3/8-inch copper lines.

e. Lift evaporator coil up and push towards the rear for removal.

Table 4-6. R-134a Temperature - Pressure Chart

Temperature		Vacuum		
°F	°C	"/hg	Kg/cm2	Bar
−40	−40	14.6	37.08	0.49
.35	.37	12.3	31.25	0.42
−30	−34	9.7	24.64	0.33
−25	−32	6.7	17.00	0.23
−20	−29	3.5	8.89	0.12
−18	−28	2.1	5.33	0.07
−16	−27	0.6	1.52	0.02

Temperature		Pressure		
°F	°C	Psig	Kg/cm2	Bar
−14	−26	0.4	0.03	0.03
−12	−24	1.2	0.08	0.08
−10	−23	2.0	0.14	0.14
−8	−22	2.9	0.20	0.20
−6	−21	3.7	0.26	0.26
−4	−20	4.6	0.32	0.32
−2	−19	5.6	0.39	0.39
0	−18	6.5	0.46	0.45
2	−17	7.6	0.53	0.52
4	−16	8.6	0.60	0.59
6	−14	9.7	0.68	0.67
8	−13	10.8	0.76	0.74
10	−12	12.0	0.84	0.83
12	−11	13.2	0.93	0.91
14	−10	14.5	1.02	1.00
16	−9	15.8	1.11	1.09
18	−8	17.1	1.20	1.18
20	−7	18.5	1.30	1.28
22	−6	19.9	1.40	1.37
24	−4	21.4	1.50	1.48
26	−3	22.9	1.61	1.58

Temperature		Pressure		
°F	°C	Psig	Kg/cm2	Bar
28	−2	24.5	1.72	1.69
30	−1	26.1	1.84	1.80
32	0	27.8	1.95	1.92
34	1	29.6	2.08	2.04
36	2	31.3	2.20	2.16
38	3	33.2	2.33	2.29
40	4	35.1	2.47	2.42
45	7	40.1	2.82	2.76
50	10	45.5	3.20	3.14
55	13	51.2	3.60	3.53
60	16	57.4	4.04	3.96
65	18	64.1	4.51	4.42
70	21	71.1	5.00	4.90
75	24	78.7	5.53	5.43
80	27	86.7	6.10	5.98
85	29	95.3	6.70	6.57
90	32	104.3	7.33	7.19
95	35	114.0	8.01	7.86
100	38	124.2	8.73	8.56
105	41	135.0	9.49	9.31
110	43	146.4	10.29	10.09
115	46	158.4	11.14	10.92
120	49	171.2	12.04	11.80
125	52	184.6	12.98	12.73
130	54	198.7	13.97	13.70
135	57	213.6	15.02	14.73
140	60	229.2	16.11	15.80
145	63	245.6	17.27	16.93
150	66	262.9	18.48	18.13
155	68	281.1	19.76	19.37

SECTION 5
ELECTRICAL SCHEMATIC DIAGRAMS

5.1 INTRODUCTION

This section contains Electrical Schematic Diagrams covering the Models listed in Table 1-1. Contact your Carrier Transicold service representative or call the technical hot line at 800-450-2211 for a copy of the schematic for your specific model.

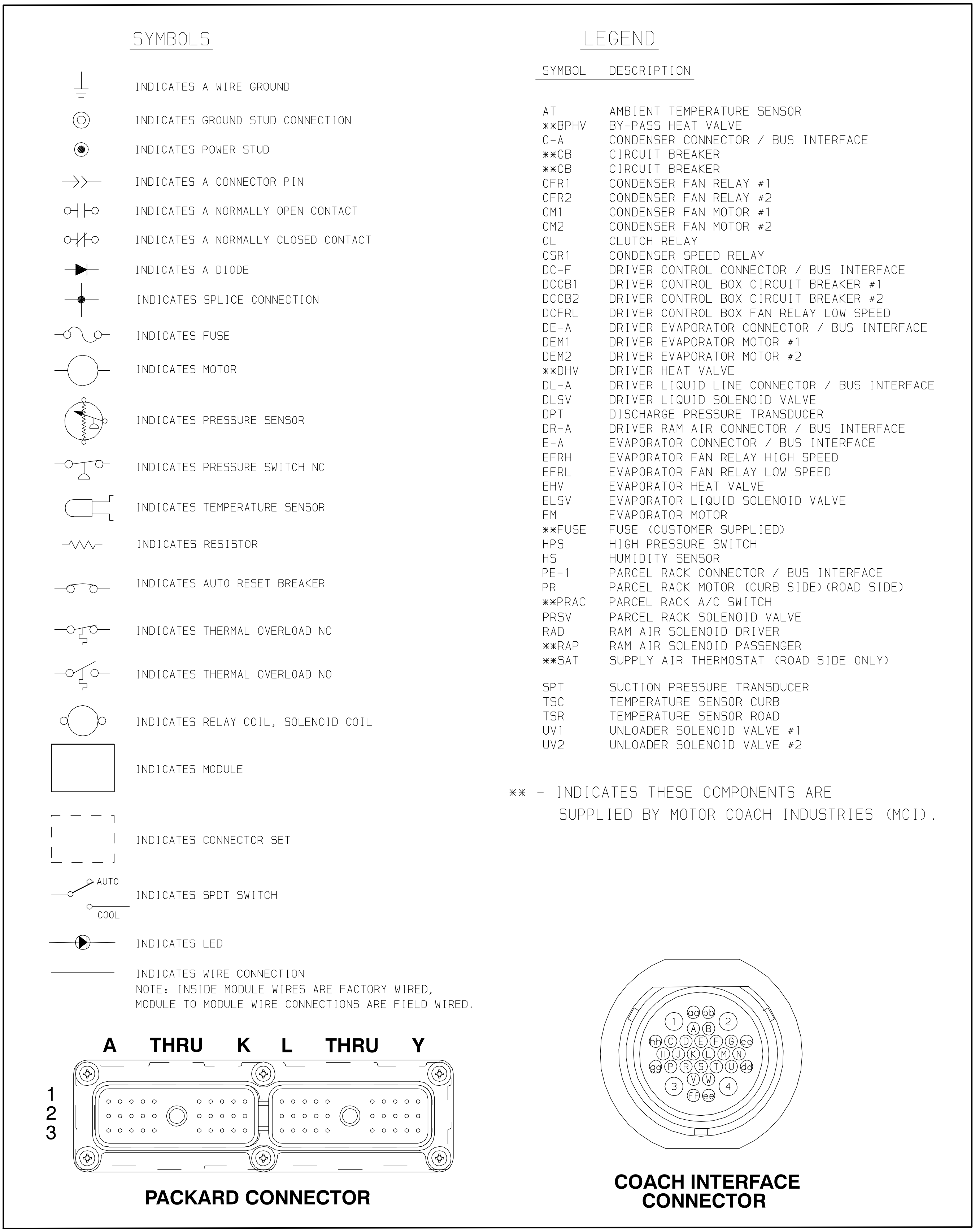
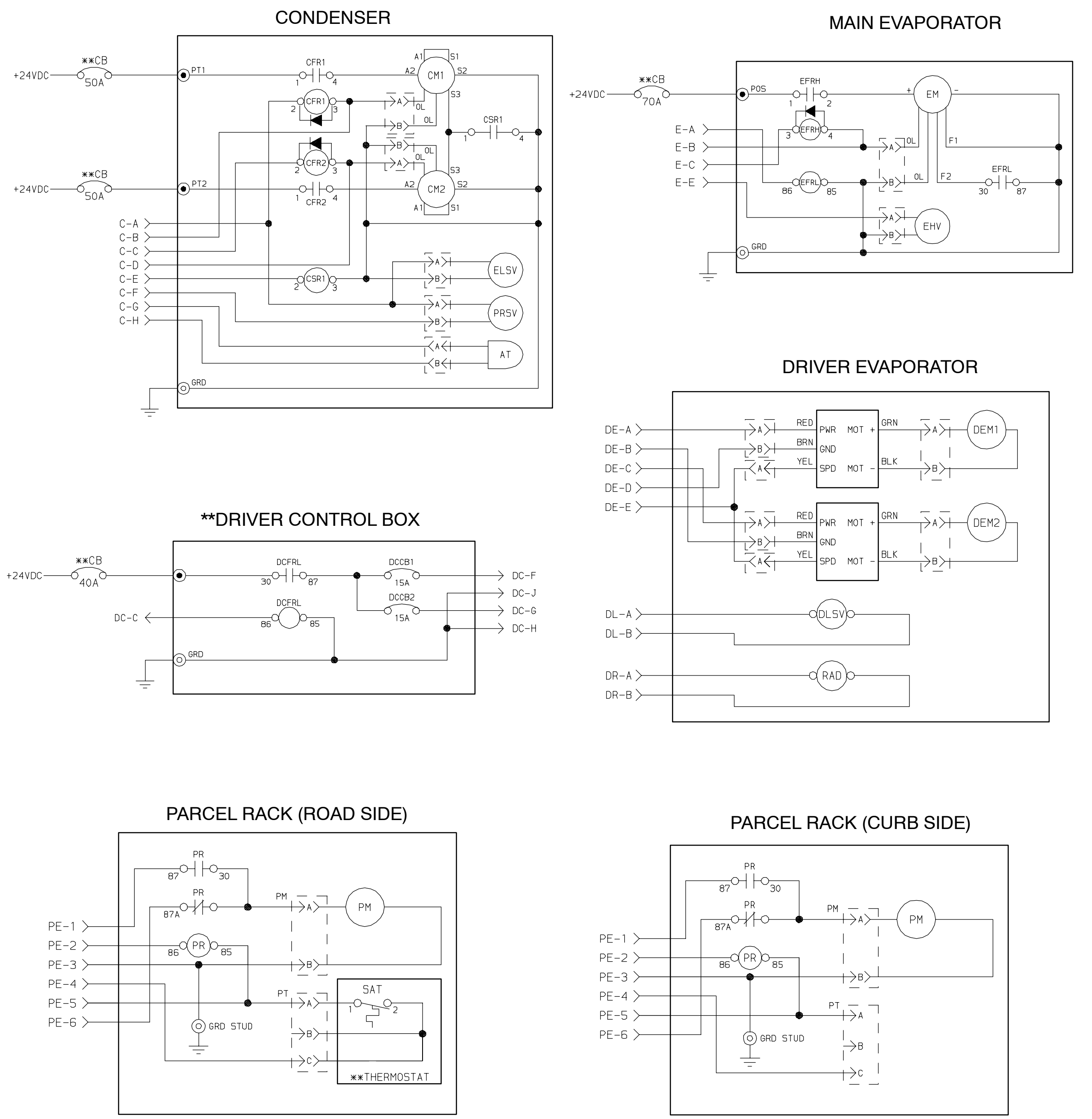


Figure 5-1. Electrical Schematic Diagram Legend and Symbols
(Based On Drawing No. 62-10907 Rev–)



NOTE

In 2003, early production units were retrofitted with diodes. If servicing a unit that is not wired as shown above, the unit should be retrofitted. Contact Carrier Service Engineering.

See Figure 5-1 for legend and symbols.

** - INDICATES THESE COMPONENTS ARE SUPPLIED BY MOTOR COACH INDUSTRIES (MCI).

Figure 5-2. Electrical Schematic Diagram, Sheet 1 of 2
(Based On Drawing No. 62-10907 Rev−)

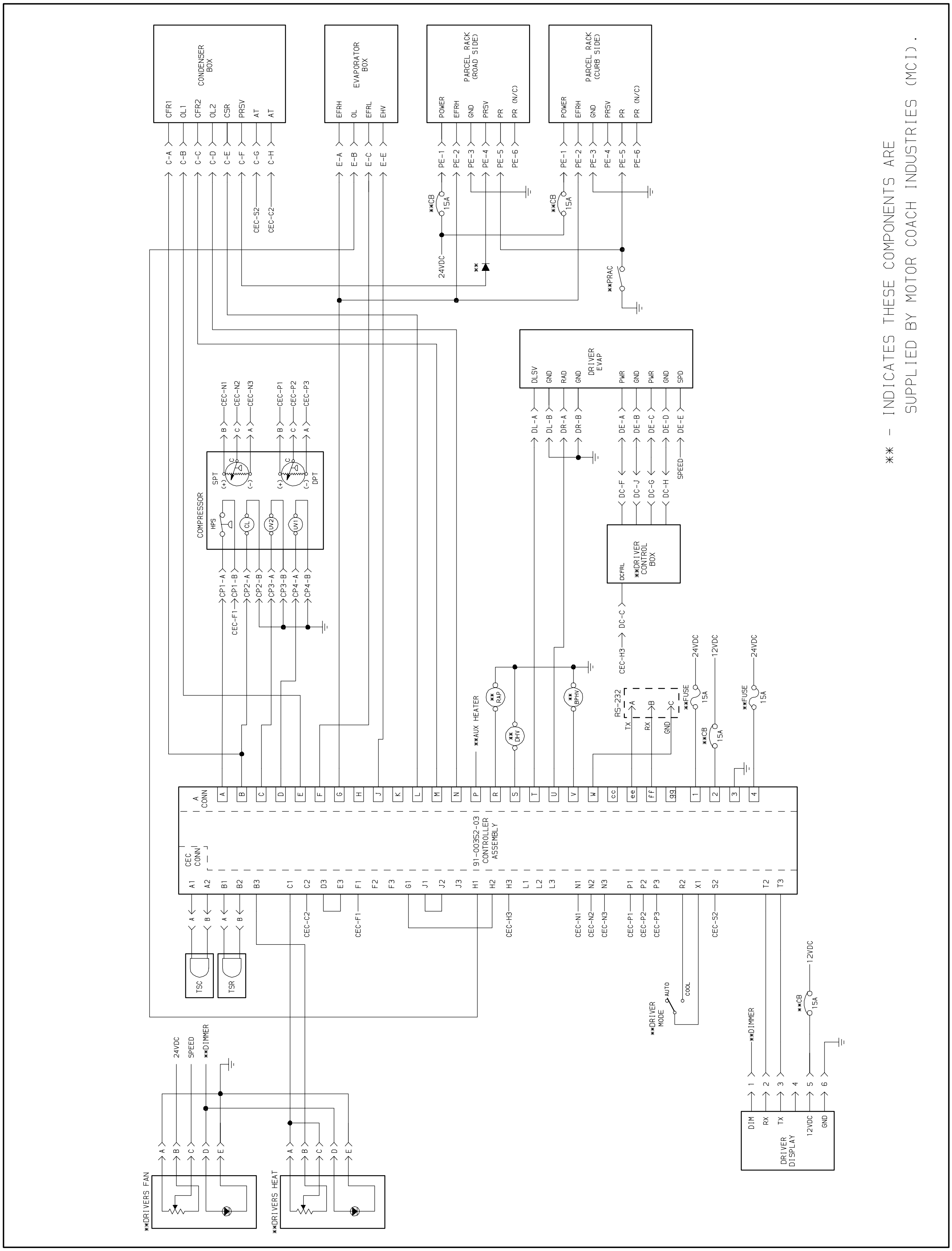


Figure 5-3. Electrical Schematic Diagram, Sheet 2 of 2
(Drawing No. 62-10907 Rev–)

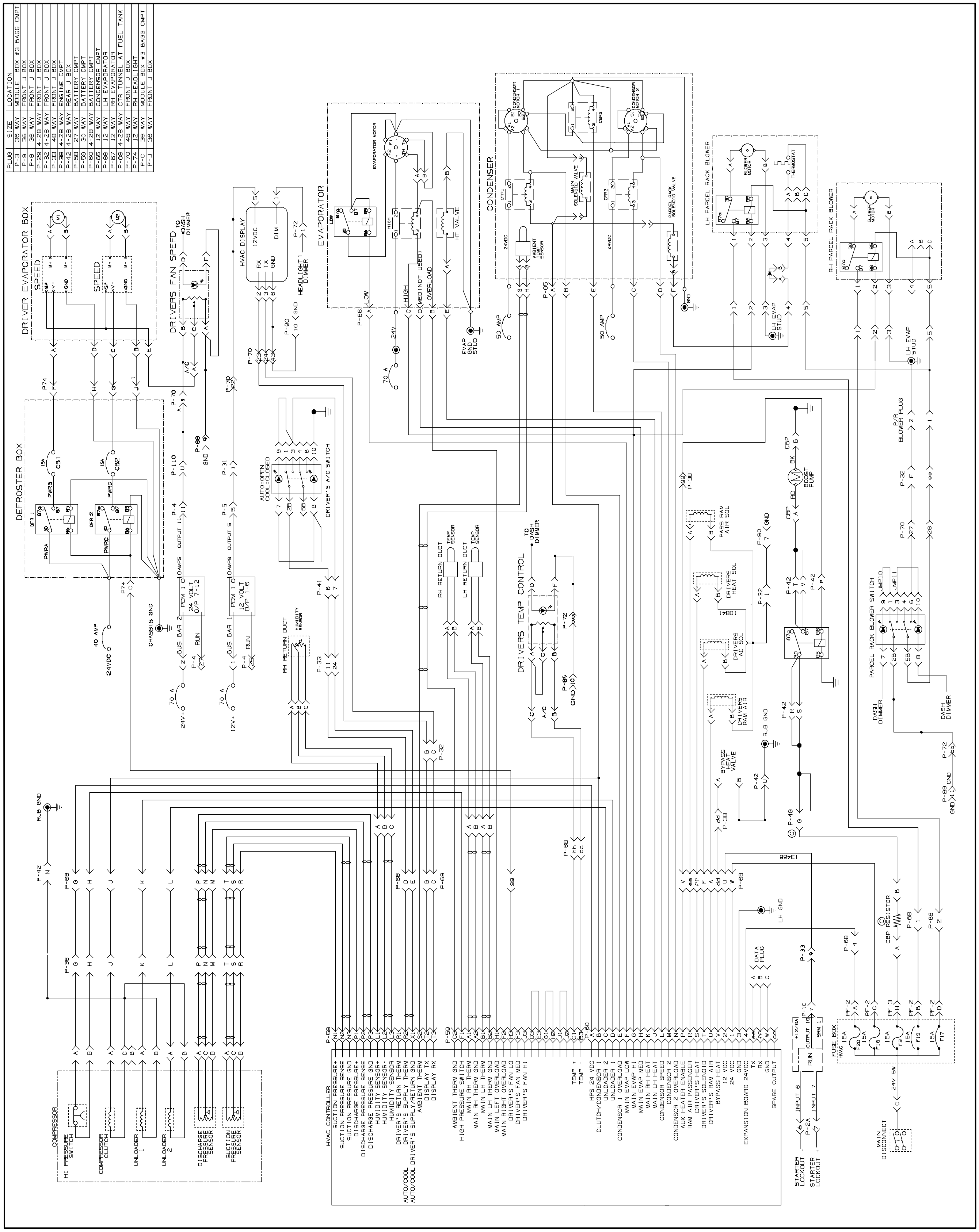


Figure 5-4. Electrical Schematic Diagram
(Contact vehicle manufacturer for a specific diagram)

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